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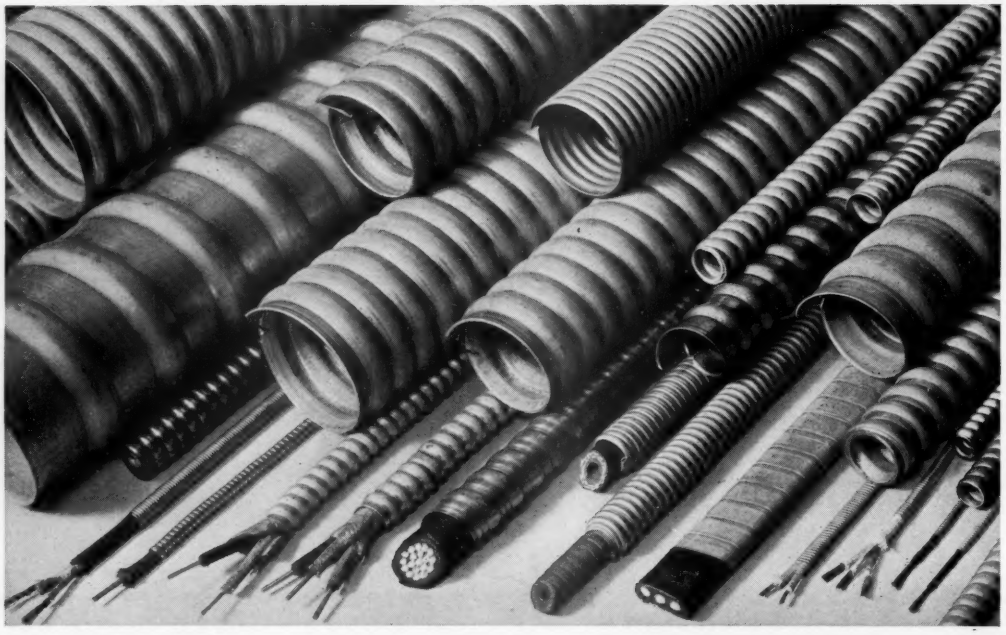

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DRAWING — ROLLING —.EXTRUDING — FORMING — FABRICATING.

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Contents

New Light on Wire Drawing .....By Prof. F. C. Thompson 69
Results Obtained in Recent Research Work in Great Britain.

Pulp—The New Cable Insulation .....By L. S. Ford 73
A Ten Year Research by Engineers of the Western Electric Company and the Bell Research Laboratories Develops a Pulp Insulation to Replace Paper Ribbon for No. 24 and No. 26 Gauge Wire.

A New Device For the Estimation of Zinc Coatings .....By A. Keller and K. A. Bohacket 76
A New Method for the Determination of the Zinc Deposit on Galvanized Wire.

'Round the World With the Wire Industry 77
(a) Novel Method of Supporting Cable Drums
(b) What Cold Working of Metals Shows

Wire Questions and Answers 82
(a) What is Cimet Wire?
(b) What Effect Has Cold Drawing on the Hardness and Physical Properties of Cold Drawn Wire?
(c) A Method of Drawing Liquor Finish Bessemer Steel from 17½ Annealed to sizes .038 to .014. How do you figure the percentage of draft?
(d) Can We Get Four Minute Wire on Prime Western Spelter as Easily as With Horsehead or Electrolytic?
(e) Baking Low Carbon Wire or Rods.
(f) Are Manufacturers of Barbed Wire Experiencing any Tendency Away From the 80 Rod Spool as a Unit of Sale?
(g) Detailed Data on the Tinning of Refrigerator Trays.

A Review of Recent Wire Patents 86

Exports and Imports of Wire 87

Buyers' Guide 95-96

—ASSOCIATE EDITORS—
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W. H. Spowers, Jr., Consultant on Galvanizing
L. D. Granger, Chief Metallurgist, Wickwire Spencer Steel Corp.
Lancaster, Allwine & Rommel, Consultants on Patent Information

European Correspondents

Great Britain
A. C. Blackall
7 Vincent Sq. Mansions
London, S. W. 1, Eng.

Germany & Belgium
Paul Fidrmuc
Chapeaurougeweg 15
Hamburg, Ger.

R. E. Brown, Business Manager
Executive and Editorial Offices:
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Vol. 8 MARCH, 1933 No. 3

New Light on Wire-Drawing

Details of the Research Work Conducted at Manchester University and the Results Secured

By Professor F. C. Thompson

Manchester University, Manchester, England

IN this issue we give the first of a series of two articles which Professor F. C. Thompson has contributed dealing with the research work which he has directed at Manchester University on wire drawing. That the work is by no means complete Professor Thompson readily admits but the data which he has already established must prove invaluable to the industries connected with the drawing of wire. To take only one example from this work, the experiments have suggested that the best lubricant is a hard soap. In the non-ferrous wire-drawing trades, however, liquid or greasy lubricants are almost invariably preferred. But a further point is of interest, for while in practice care is taken to cool the lubricant these experiments have shown that if the temperature is allowed to rise, to the boiling point of water for instance, then some greasy or liquid lubricants are equal to or better than, hard soap. The main consideration of the experiments has been power consumption and this is inevitably an aspect of the problem which appeals very strongly to the wire-drawer on account of the possible reduction in operating costs. Professor Thompson sounds a note of warning, however, when he points out that this is "only one of the problems to be solved. The mechanical properties of the material and relative costs in other directions are of at least equal importance." Obviously the research work must be continued, but, in the meantime, the wire-drawing trades must be exceedingly grateful for the valuable facts which this work has already placed in their hands.

The Editor

Relation of Tension and Drawing Speed

THE production of wire, at first merely for ornamental purposes, was one of the very early mechanical arts. Among ancient Egyptian remains, for instance, necklaces have been found consisting of beads strung on gold wire. The first method of manufacture is probably well described in the words of the 39th chapter of Exodus: "They did beat the gold into thin plates, and cut it into wires." Later the strips so produced were hammered into the round form with which we usually associate the term. It should not be forgotten, however, that even today some wires are drawn which are not circular in cross-section, and sometimes through dies the holes in which are not completely filled. The modern method of drawing wire, at first by hand and later by mechanical power through tapered holes in hard dies, is usually ascribed to the fourteenth century craftsmen in Germany, though it is highly probable that it antedates the fourteenth century by several hundred years.

+ + +

ALTHOUGH greatly modified in detail, the process in essence is not greatly changed from that of those very early days, and until the last few years not much more was known concerning the fundamental principles involved. Recent research, in large part in Germany and this country, is, however, gradually placing the industry in the possession of some, at any rate, of the basic principles upon which the drawing of wire ultimately rests. The factors involved are very numerous, and include such questions as the ideal shape and angle of the hole through which the metal is to be drawn, the material of which the drawplates are made and its treatment, the nature of the lubricant used, and the temperature which is attained. Tungsten wire, for instance, is said to be generally

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drawn from the sintered rod at a temperature of about 700 deg. c.

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Factors in the Process

OTHER matters which affect the success, or otherwise of the operation include the speed of drawing, which may now be well over half a mile a minute even in the so-called cold-drawing, the reduction brought about in the area of cross-section of the metal, the relative advantages in producing this reducton in a single pass or in multiple passes through the die, the relationship of the power required to the mechanical properties of the material treated, etc. Further, such questions arise as concern the ideal forms of heat treatment before, during, and after the actual drawing and the problems involved are by no means completely enumerated even there. It is clear then that the subject of wire-drawing as a whole affords scope for endless researches, some of which are essentially of an industrial, others of a laboratory character. Since, in collaboration with his students especially Mr. E. L. Francis, the writer has done some of the work in this field, it appeared justifiable to give a summary of certain of the results which have already been attained.

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The Mathematical Approach

A flood of light would be thrown on the process if a sound mathematical treatment of the flow of metal through a drawing die were possible. Once the stresses involved exceed the elastic limit of the material, however, mathematical treatment of their effects becomes essentially impracticable, and the approximate solutions which have been obtained have been based on assumptions which do not appear to accord with experimentally d e m o n s trated facts. There are excellent reasons based, for instance, on photo-elastic researches, for the belief that the stresses to which the metal is subjected during the time when it is actually passing through the die are exceedingly variable, decreasing enormously from the entrance to the exit end of the die and from the surface of the metal to the centre.

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IN mathematical treatment, as yet only the mean stresses have been considered whence the conclusions reached must deviate to an indeterminable extent from reality. Further, as the material is being drawn down, the flow is such that the centre of the rod normally moves in advance of the surface layers, an originally plane cross-section thus becoming gradually bowed outwards towards the exit from the die. This fact, which has been shown by several workers using very different experimental methods again introduces complications which the mathematician has not so far been able to take into account. It follows, therefore, that even the most fundamental research on the subject must at the moment remain in some degree empirical whilst the influences of the various factors involved are being sorted out. Certain of the results of mathematical treatment are, however, of value in pointing out directions for future experimental work. By far the most useful of such conclusions so far have been those derived from a "dimensional" study. It can for instance be shown in this way that the power needed to draw wire should be directly proportional to the speed of drawing, to the area of cross-section of the wire, and to the original tensile strength of the material being drawn. The first of these conclusions leads to the, at first sight, very surprising deduction that the tension required to effect a specified reduction for a material of definite properties should be independent of the speed at which this wire is drawn. Except at very low drawing speeds, however, this has, as will be shown in more detail later, been completely confirmed.

The Lubricant

MATHEMATICAL treatment of the whole problem is of value in another direction. The coefficient of viscosity of a lubricant is greatly modified by pressure. In wire-drawing the pressure set up between the metal and the die, although far from completely known, must be of a very high order, probably in some cases for more than 100 tons per square inch. It follows that we know very little with any certainty regarding the coefficient of viscosity of the lubricant in drawing. What little is known can be deducted only by substitution i nthe mathematical formula, and though the result is but a very wide approximation, yet it is better than nothing, and is the only avenue by which the result can be approached.

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THE apparatus designed for the work now to be described consists essentially of a strong horizontal arm of channel section pivoted at its centre. The die is bolted to this arm at one end, and through a hole in the arm the wire is drawn on to a drum. As a result of the pull thus set up the lever arm carrying the die tends to move forward and is brought back into its original position by means of a piston which presses against the other end. This piston is actuated by means of a cylinder into which compressed aid can be forced under very sensitively controlled conditions. The undeflected position of the whole arm is determined by means of two electrical contacts, and when this state of aairs is attained, the air pressure, in pounds per square inch, in the cylinder, which is measured on one or other of two pressure gauges, is exactly one-tenth of the pull in pounds upon the wire.

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Experimental Results

WE may now pass on to consider the main results to which the experimental work has

led, and deal in the first case with the relationship of the pull required to draw the wire to the speed of drawing. At low speeds, such, for instance, as those attained in drawing very heavy sections on a draw bench, the tension is found to rise slightly as the speed of drawing is raised. Above some such speed as 20 feet per minute, however, and perhaps distinctly less, the pull remains in many cases almost independent of the rate at which the wire is being drawn. The exact relationship, however, depends on the material from which the drawing die is made, or more accurately perhaps on the effect of this upon the perfection or otherwise of the lubrication. With hard steel dies the pull increases with the speed even with the best lubrication which can be provided. This applies to all the materials which have been examined. When sintered tungsten carbide dies are employed, however, the tension, although essentially constant, may remain unchanged, and may fall or rise slightly.

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THERE is good reason for the belief that where either of the two latter possibilities occurs it is to corresponding changes in the lubrication that the effect is in reality to be ascribed. When, for instance, aluminium is drawn, using water as the only lubricant, the tension in a specific instance rose from 45lb. at a speed of 3 feet per minute to 50lb. at 35 feet per minute. In another case when a 7 per cent nickel-silver wire was drawn using the colloidal suspension of graphite in oil known as "oil-dag" the pull fell from 70lb. at very low speeds to about 58lb. at 300 feet per minute. The heating which necessarily occurs with very rapid drawing unless cooling arrangements are provided, and which, as will be shown later, tend to improve from the present point of view the quality of a lubricant would provide an adequate explanation of this effect.

Tension Independent of Speed

ON the whole, then, it can be said that at commercial drawing rates the tension necessary, other things being, of course, the same, will be essentially independent of the speed. This conclusion, although not one which would have been expected, has been confirmed for so many different materials that there can be no doubt as to its validity. Up to 600 feet per minute, the highest speed at which this work has so far been carried out, the tension is much the same whatever the speed may be for steel, non-ferrous metals, annealed or already cold-drawn material. From this it follows that the power consumed is directly proportional to the speed of drawing as the dimensional analysis had already indicated. As one instance of this may be given the results for a mild steel reduced 18.6 per cent from an original diameter of 0.0715in. in a tungsten carbide die, a good soap being used as lubricant. At speeds of 3, 20, 115 and 590 feet per minute, the work done per minute amounts to 186, 1,276, 7,360, and 37,800 foot-pounds respectively.

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II.

Tension and Tensile Strength

THE next aspect which may be considered concerns the relationship of the tension needed to effect a given reduction through a die of constant contour to the mechanical properties of the metal or alloy being drawn. It may appear to be a matter of only academic importance as to how the atoms in a metal tend to arrange themselves. As will be shown, however, as far as the power required to draw wire is concerned, this atomic arrangement is one of the vital factors. Most industrial metals and alloys crystallise in the cubic system, for the most part in what the crystallographer calls face-centred and body-centred lattices. In the first case the unit cube has an atom at each corner and another at the centre of each cube face, and this is the normal arrangement for the non-ferrous metals and alloys such as copper, aluminium, brass, bronze, &c. In addition, some special steels, such as the very high nickel-chromium alloys, low in carbon are arranged in a similar manner. The body-centred cubic lattice has an atom at each corner and one at the middle of the cube, but none in the centre of the cube faces. The ordinary steels all contain a constituent of this type. Now under stress the two types of lattice react differently, with the result that when a steel or a non-ferrous metal is being drawn into wire under otherwise identical conditions the power required will normally not be the same.

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IF the tension needed to effect a given reduction of area for a wire of definite size drawn through a die of given angle is plotted against the maximum stress or elastic limit of the material prior to the reduction, the curve obtained is a straight line. The proportionality is, perhaps, rather better for the elastic limit than for the maximum stress, but in view of the greater facility with which the latter value may be determined, it is better adapted for consideration here. This straight line applies only to those materials which crystallise in a given lattice, and although it holds quite accurately for the non-ferrous metals which crystallise in the face-centred cubic lattice on the one hand, and for the steels which have the body-centred arrangement on the other, the two sets of results are, except apparently for a single reduction of area which depends on the actual conditions, not the same. Thus for a reduction of area of about 20 per cent a mild steel with a tensile strength of about 23 tons per square inch in the undrawn state would require a tension of about 9.5 tons per square inch with a tungsten carbide die of 6 degrees semi-angle. A non-ferrous alloy, say, for instance, a nickel-silver, with the same original maximum stress would need a tension of but

6.5 tons per square inch for the drawing. It is very clear, therefore, that the atomic arrangement of the material is in reality a factor of very real importance to the wire-drawer.

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LEAVING this aspect of the question out of account, that is dealing only, say, with non-ferrous metals and alloys which crystallise in the same manner, the proportionality between the pull needed to draw the wire and the tensile strength of the latter is strictly linear from the softest to the hardest materials. Under conditions of almost perfect lubrication this line passes almost exactly through the origin, so that if the tensile strength is doubled the power needed will be doubled at the same time. Under industrial conditions, where the lubrication cannot be as good, the net result appears to be that to the power which is needed actually to deform the metal must be added that wasted in friction at the surface of the die. This frictional loss appears to be essentially constant whether the metal is hard or soft.

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Material of the Die

THE materials used for the production of the dies include steel both intrinsically hard due to its high carbon content, and quenched, chromium and tungsten steels, white cast iron, used more in other countries than in this, tungsten carbide (an intensely hard substance sintered with small amounts of iron, nickel, cobalt, &c.), diamonds and other precious stones, and even, it is rumoured, possibly in the near future of a specially treated tough glass. A considerable amount of work has been carried out on the relative power required to draw wires through dies of some, at any rate, of these different materials. In all the cases examined it has become evident that the power consumption is higher with steel dies than with those made from tungsten carbide, sometimes very appreciably so. It is not exceptional to find that an economy of the order of 30 per cent in the power used can be effected by the replacement of steel by carbide dies. The length of service of the latter prior to resetting is also very much greater.

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SINCE carbide dies are somewhat susceptible to the thermal stresses set up if the temperature is rapidly altered, some care in their use is essential if flaking is not to occur and pre-heating or the use of cooling appliances may be required. The difficulties, however, are not great, and with reasonable care the material never ceases to be exceedingly useful. The writer has not had as yet much experience of the use of carbide dies for drawing the heavier gauges of wire, but they have been employed in his department for wire up to about one-tenth of an inch in diameter, and the results have invariably proved highly successful. Not only is there this economy of power already referred to but with carbide dies materials generally considered to be somewhat difficult to draw at high speeds, such as high carbon steels, alloy steels of the stainless types and nickel-chromium alloys, have been drawn with the greatest ease, even when the speed has been as high as, or ever higher than, those normally used in industry. For this the dies themselves must in large measure be held responsible.

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THE work which has been done so far with diamond dies in the Metallurgical Department of Manchester University, though not great, has shown that for those cases where really efficient lubrication is possible the power consumption is exactly the same as that required for tungsten carbide dies. With the less efficient liquid lubricants, however, the diamond dies are the more economical in the amount of power used.

Straight Conical Opening

ALL the work which is considered in this article has been done on material which has already been drawn and which has a good smooth surface quite free from scale. Where hot-rolled rods are receiving their first pass, and the surface is irregular and possibly incompletely descaled, the results which will now be described may not hold good. There is, for instance, in practice a tendency in the case just quoted to use dies with a distinctly steeper angle than the best, and this fact should be borne in mind in connection with what is now to be stated. Apart from this type of drawing, however, it has been found in all cases that the best type of contour of the hole is a straight conical opening. Since this work has been carried out upon ferrous and non-ferrous metals and alloys ranging from the softest iron, copper, or aluminum to high carbon patented steels, Monel metal and the nickel-chromium alloys, and since the best die angle is the same in every instance there would appear to be good grounds for the view that this is invariably the case. At any rate we know of no exception.

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STARTING with a die of a plain conical taper and a semi-angle of 2½ degrees, the work done in effecting a stated reduction of area falls at first progressively as the angle of the die is increased. At an angle of around 5-5½ degrees a minimum occurs in the power consumed, after which as the angle is still further increased there is a second increase in the tension necessary. This is not, however, in general nearly so marked as the falling off with angles less than the optimum.

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IT was not expected when the work was commenced that the best angle—i.e., that for which the power consumption is a minimum—at any rate for carbide dies, with which all this section of the

(*Please turn to page 93*)

Pulp--The New Cable Insulation

By L. S. Ford

Outside Plant Development, Bell Telephone Research Laboratories

The history of Telephone cable is a living story woven into the vast intercommunicating network of the Bell System. Not the least fascinating of its chapters is the story of insulation development. That story is not completed; each paragraph written is indicative of continuous progress. The most recent of these paragraphs is concerned with the development of a new insulation, a development characterized by many and at times seemingly insurmountable manufacturing obstacles, which finally culminated in the introduction of pulp insulated cable. ▼ ▼ ▼

THE satisfactory insulating of fine wires with wood fibres applied directly to the wire in the form of pulp was the objective of ten years of intensive study and experiment, originating in the Western Electric Company and subsequently prosecuted cooperatively by Western Electric and Laboratories engineers. Narrow strips of paper ribbon which for the past forty years have served so remarkably well, find themselves suddenly displaced by pulp as a better standard for the insulation of No. 24 and No. 26 gauge wire for exchange area cables.

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ONE of the main promotive ideas which initiated the development of pulp insulation was that of utilizing an inherently inexpensive fibre. Using nothing but wood-pulp, the contemplated procedure was to embed each wire in a ribbon of the pulp, and to turn this ribbon down into a cylindrical sheath while still wet. This general procedure has been embodied in a continuous manufacturing process, which takes advantage wherever possible of methods and equipment used in paper-making.

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PULP for use as insulation is prepared from jack pine or spruce by an outside supplier. He chips the wood, cooks it with a sulphate solution, and finally washes and dewaters it. In the works of the Western Electric Company the pulp is mechanically worked with water, which reduces it to its individual fibres and hydrates them to such a state that they will form a suitable covering. From tile storage tanks the pulp is taken as it is needed, diluted to about a twentieth of one per cent, and is then piped to a paper-making vat.

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ALSO passing continuously to this vat are sixty wires, supplied by rotating fliers from stationary spools on a supply stand which accommodates two spools in each of the sixty positions. As each spool is emptied, an operator can braze the end of its wire to the outer end of the wire on a full spool without stopping the machine. An electrolytic cleaner then removes residual drawing compound, preparing clean copper surfaces to which the insulation will adhere.

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INTO the vat dips a cylindrical screen, continuously rotating about a horizontal axis. The pulp about the outside of the cylinder is filtered by passage through the screen, the water passing out through an outlet inside the cylinder. The deposition of pulp on the screen is confined to sixty narrow ribbons by lacquer dams. The

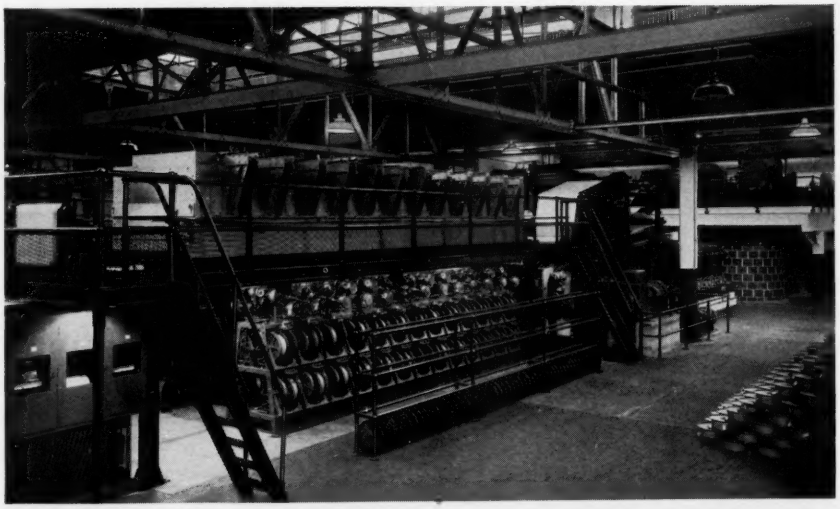

Fig. 1—Pulp is thrown into the beater, kneaded with water, and then dumped into the storage tanks beneath.

wires are brought into contact with these ribbons when they are partially formed, and the remainder of the deposition then takes place, leaving each wire embedded in a ribbon.

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WIRES and ribbons are transferred intact from the screen by an endless travelling woolen blanket pressed against them by a couch roll. This blanket serves both as a driver for the cylinder and a carrier for the tender sheets. To protect the ribbons from rupture, a second felt is laid over them. Felt and ribbons then pass through two sets of press rolls to remove excess moisture and permit the ribbons to be separated from the felts. Still containing about seventy per cent moisture, the ribbons now pass to the polishing machine which turns the pulp down over the wire.

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THIS machine contains sixty rapidly rotating heads, through whose axes the wires pass. Each head bears three blades of which one deflects the travelling wire from a straight line against the other two, with a pressure controlled by the tension on the wire. From these heads the wires emerge, each covered with a uniform wet sleeve of pulp.

TO drive off the remaining moisture, the wire is passed through a box-type electric furnace, twenty-six feet long. By thermostats the entering zone is maintained at a red heat, the second zone at about nine hundred degrees Fahrenheit, and the tempering zone at about six hundred degrees. Drying at these high temperatures leaves the insulation porous and relatively unshrunk. On a stage at the far end of the furnace, a rotary pulling mechanism draws the wires through the polishing machine and drier, and delivers them to take-up reels arranged in pairs for continuous operation.

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PULP insulated wire is structurally different from wire insulated with air-spaced paper ribbons. The insulation is firm with no appreciable air space between it and the wire, bundles of wires nestle together differently when grouped into a given space, and when pairs are stranded together in the usual manner the unit thus formed is considerably less flexible than with ribbon insulation. Sharp kinks form with even moderate cable bends. While this feature is less pronounced for small cables it is, of course, objectionable, and an improvement in the handling qualities is effected by stranding several layers in the same direction rather than reversing successive layers. For the large size cables, a design whereby the pairs are first grouped into units of fifty or one hundred and these in turn stranded together into a cable gives a construction which offers the most satisfactory arrangement. This is illustrated in Figure 4 which shows a full-size cable containing eighteen 101-pair groups of No. 26 gauge conductors.

Fig. 2—The wires embedded in ribbons of wet pulp leave the press rolls (center) and enter the polishing machine (right).

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NEXT to obtaining a continuity of insulation sufficient in amount to withstand the necessary dielectric stresses, the most important electrical characteristic is low mutual pair capacitance. The earlier pulp cables

had a capacitance at 900 cycles 20 to 25 per cent higher than similar paper-ribbon cable. This impairment in transmission efficiency was considered prohibitive for cables to be used for interoffice trunks, and was definitely objectionable for any cable. The indicated savings in cable first cost, however, warranted continuing the development, and over a period of years marked progress has been made in reducing this excess of capacitance.

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MANY factors have brought about this reduction in capacitance.

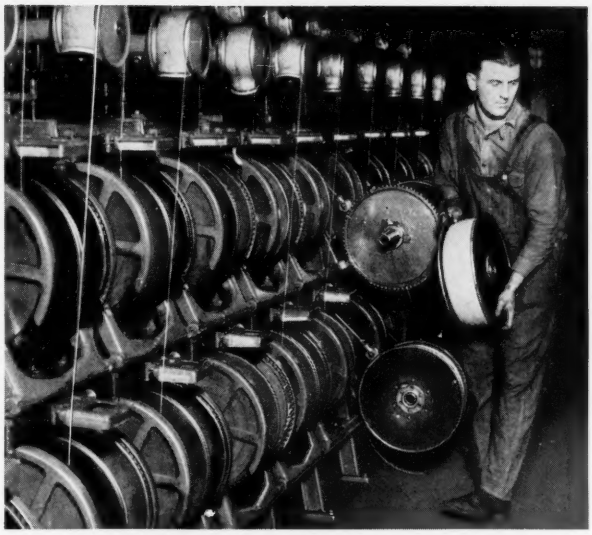

Fig. 3—The finishd insulated wire is spooled beneath the drier. ✦ ✦

The treatment of the pulp itself has been improved. Refinement in machinery operation has enabled the use of a lower density covering. Improvement in the process has resulted in more nearly round and better centered insulation. The rapidity with which the radiant heat dryer expels the moisture from the pulp, results in less shrinkage of the insulation on the conductors and leaves the insulating medium light in weight for the volume occupied. Although a substantial improvement has been made in lowering the mutual capacitance to values much nearer those corresponding to ribbon-insulated cable as shown in figure 5, efforts are being directed toward a further reduction in capacitance.

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NO new practices are involved in installing pulp insulated cable except in the boiling out of the cable ends preparatory to the splicing of the conductors. Even the most flexible pulp insulation so far produced, when impregnated with straight paraffin wax, will not withstand satisfactorily the handling incident to splicing at low temperature. A softer and more lubricating type of compound is required, and has been found by adding paraffin oil to the wax. Another problem requiring attention arose from the fact that the natural brownish color of the unbleached pulp results in less sharp color distinction for the different groupings than with ribbon insulation. By simplifying the color code, however, sufficient contrast in the shades is obtained for the satisfactory matching of colors in splicing.

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MILLIONS of feet of wire are now daily being insulated with pulp, fabricated into cables and put in service in the telephone plant. Thus pulp insulation, young as it is, has already reached a prominent place in cable history and because of the substantial economies which is promises, it must play a conspicuous part in the Bell System's engineering in the future.

✦ ✦ ✦

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Fig. 4—This 1800-pair No. 26-gauge cable illustrates the application of unit standing to pulp-insulated cable. ✦ ✦ ✦ ✦ ✦

Fig. 5—The improvement effected in the last four years of development is shown by the decrease in the percentage by which the capacitance of pulp-insulated cables has exceeded that of their ribbon-insulated predecessors. ✦ ✦ ✦

A New Device For The Estimation of Zinc Coatings

By A. Keller and K. A. Bohacek

Translated from Draht-Welt of August, 21, 1932

By Kenneth B. Lewis, Consulting Wire Mill Engineer

The Description of a New Method of Universal and Easy Application for the Determination of Zinc Deposit on Galvanized Wire ▼ ▼ ▼ ▼ ▼ ▼

THE evaluation of quality in galvanizing involves, along with tests for mechanical properties such as the strength of the coating as disclosed by bending and twisting, above all else the thickness of the zinc covering, for if the adhesion is satisfactory the resistance to corrosion increases directly with the amount of cover. The standards now effective are based on the amount of zinc per unit of surface, a decisive change from previous standards.

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THE testing of zinc coatings has hitherto been done almost exclusively by the so-called Preece test, which consists in dipping the sample into copper-sulphate solution of specified composition, and only in exceptional cases has there been an accurate determination of the weight of the coating. Such determination has been made by dissolving off the zinc in mineral acid, the base metal being protected by inhibitors. (Bauer method, Aupperle methods, etc.)

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THE Preece test is rather crude at best. It gives only an approximate determination of the amount of coating, through the fact that experience has shown that a solution of one part of copper sulphate in five parts of water will dissolve from one square meter of surface about 35 grams of zinc in a minute. So, for instance, four one minute immersions indicate a coating of 140 grams per square meter, if you ignore the fact that at the first sign of failure there is still considerable zinc on the wire.

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THE test is of questionable value by reason of the further fact that zinc dross coatings, and highly oxidized coatings withstand more dips than pure zinc. This may cause good wire to be rejected and inferior wire to deceive the inspector by standing more dips, and has led to a state of affairs in which operators are impelled to make their prime objective the passing of a dip test rather than the production of a high grade wire. The dip test has a strictly limited value; it ranks only as the simplest comparative test. The slow dissolving and the easy detection of the first precipitation of copper indicate at once whether the zinc coating covers the entire surface uniformly or not. The Preece test fulfills this definite task, and does it well, and it must not be asked to do more.

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THE above mentioned method of exact determination of zinc by dissolving off the coating in a mineral acid is not always easy of application, as it implies the existence of a delicate chemical balance located at some distance from the galvanizing department, and the services of a skilled technician. Attempts to simplify the process and the equipment have not met with much success. Moreover this method of solution and weighing does not take into account the heterogeneous nature of the zinc coating. It is well known that a galvanizing coat does not consist of pure zinc; there is always some 6% of iron, generally .8 to 1% of lead, and in addition those metals deliberately alloyed with the zinc and those carried in as impurities in commercial spelter. These other metals go into solution and have to be calculated as zinc. The same is true of non-metallic inclusions, particularly oxides.

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ATTEMPTS have been made to substitute for the inexact Preece test and the inconvenient analytical method one which would be sufficiently accurate and at the same time simple and capable of application by the galvanizing crew, and efforts have been made to develop for this purpose the method of measuring the gases evolved during solution of the coating in acid. Such a test is in common use in the United States (under the name of the Cushman test) for galvanizing sheets and there has been no lack of efforts to adapt it to the testing of wire. It has seemed impossible to devise a satisfactory equipment, that in service being operable only by skilled chemists. Either the method or the apparatus had to be entirely changed. The authors of this paper have now developed apparatus which makes this testing method of universal and easy application for the determination of zinc deposit on galvanized wire.

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THE method of operating this device is as follows. After filling the measuring and reaction tube with dilute acid the wire sample is dropped in through the upper stop-cock, which is then closed. The amount of hydrogen given off can be read on the graduated tube after the gassing has stopped and the pressure has been equalized through the over flow-flask. From the volume of gas the amount of zinc in grams per square meter of surface can readily be determined, as explained below. This test takes about 3 minutes, so is actually a shorter test for heavy

(*Please turn to page 88*)

'Round the World With the Wire Industry

Germany Reports Japanese Demand for Wire Rods

THE excellent demand for wire rods from Japan during the past five weeks has been almost as good as three or four years ago and the certainty that the demand will continue satisfactorily during the next weeks has caused the continental wire rod cartel to advance the prices for wire rods from $26.50 to 27.75 per ton cif. The demand from other markets is also better and all continental countries will exceed their allotment for the first quarter of the year.

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Japanese Export Competition With Germany

AS already reported the German wire cartel has announced the necessity of competing against the Japanese for wire nails, in Asia and Africa and in certain districts, especially India, has actually cut prices by 17/6 s per ton. The Japanese competition has not been as severe during the past few weeks as was the case at the end of last year. Their industry is overstocked with orders, deliveries are not executed in time, shipment takes from twelve to fourteen weeks, which is not convenient, and prices are higher than at the end of last year, therefore new business is now decidedly weaker. In China the continental wire products are now dominating the market, as Japanese wire products are boycotted. In South China, needles (sewing and others) imported from Japan amounted to $55,387 in 1931 as against $453,-879 in 1930 and $827,366 in 1929, while 1932 showed only 8,276 with not a single needle shipped in November and December.

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Germany Reports Improvement in Square Wire Netting Sales

THERE is a very steady improvement on the market for square wire netting. This product is now sold for export in rather large quantities, as new methods of rolling the netting very densely have reduced freight rates. The chief market is South America, but recently shipments have been started via the Panama Canal to the Pacific Coast of the United States. There is every likelihood that this business will develop with the Gulf Ports and West Indies as well.

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German Wire Machinery Business Increasing

THE German wire machinery industry reports that business in most of the various types of wire machinery is showing a steady improvement. The demand in Germany and other European markets, especially Great Britain is better, but overseas business is still quiet. Japan is the only exception, buying a number of wire drawing units.

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Germany Exports Square Wire Nails

ON the export market, the main feature is the improvement of the demand for square wire nails. These nails have been bought up to now chiefly by Northern European countries and on the German domestic markets. Now, however, they are selling in Portugal, West India, Central America, the Balkan countries and the Near East as well. Square wire nails are slightly more expensive but in spite of this customers are buying them in large quantities.

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Cable Makers Seek Gutta Percha Substitutes

THE production of gutta percha substitutes has been greatly stimulated by the steady increase in the price of the commodity brought about by the steadily decreasing supplies. During the past few years all kinds of ideas have been tested, all aiming at the production of a low-priced and satisfactory substitute. Among those tried have been processes for the improvement of inferior gutta to make it saleable, dilution of good gutta with rubber, resins, waxes, bitumens, and the like with no rubber or gutta content; and latterly the use of deproteinized rubber softened with waxes. Certain of these compositions now command a respectable market, but none has proved to be entirely satisfactory. Thus the search for the perfect substitute continues.

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THIS, E. S. Ali-Cohen now claims to have evolved. Hitherto, gutta percha substitutes of the varieties mentioned above have necessitated more or less complex manufacturing processes and at best are but mixtures of solids apt to suffer from lack of homogeneity. On the other hand, Mr. Ali-Cohen's "Alco gutta" is made by adding an emulsion of one or more resins and waxes in alkaline soap solution to latex with any suitable fillers desired. The mixture is then coagulated by means of an aluminum salt which forms an aluminum soap. This product can be made completely homogeneous, transparent and uniform.

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IT has a number of valuable properties, hardening rapidly. Its dielectric constant is the lowest known in cable practice and the addition of pure gutta percha does not improve this property. By suitable choice of fillers a varied range of qualities (in regard to strength, price, and electrical characteristics) can readily be obtained.

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APART from its obvious uses in electrical insulation, compounds, etc., the new product has a number of interesting applications in a wide range of industries.

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ANOTHER new product which the gutta percha shortage has recently brought to the attention of cable makers is natural karite, better known as "Shea butter", the closest approach to gutta percha found in Africa. It is a solid, yel-

'Round the World With the Wire Industry

lowish fat found in the seeds of the Bambouk rubber plant, a sapotaceous tree, and the karite is separated from it during soap manufacture. Exhaustive investigations recently conducted by two German scientists show this product to be a rubber hydrocarbon of the same type as gutta percha, balata and caoutchouc. It is the only natural product which can be used as a substitute without the admixture of other materials.

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Byng to Control British Telephone Propaganda

E. S. BYNG, managing director of Standard Telephones and Cables, Ltd., and a well-known figure in the British wire industry, has been elected chairman of the Telephone Development Association, the body which has charge of Britain's telephone propaganda campaign.

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British Railroad Electrification Involves Many Cable Contracts

THERE were some interesting cable contracts fulfilled in connection with the recent electrification of the London-Brighton line of the Southern Railway, the first main line railway in the United Kingdom to be electrified. For color light signalling W. T. Henley's Telegraph Works Co., Ltd., provided approximately 82,000 yards of multi-core lead-alloy-sheathed cables. The same concern also provided pilot cables for sub-stations amounting to approximately 10,000 yards of rubber insulated lead-covered, armored and served multi-core cables for a working pressure of 660 volts, and approximately 18,000 yards of single-core fire-resisting compounded and varnished 660-volt cables.

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MANY thousands of yards of signal cables of various sizes from single core to the heaviest multi-core type were supplied by Johnson & Phillips, Ltd., of London. The whole of the track feeder cables and jumpers installed since the beginning of the Southern Railway electrification have been the work of the Macintosh Cable Co., Ltd., of Derby. Approximately 50,000 yards have been used on the Brighton section, while since 1924 four times that quantity have been delivered to the railroad company.

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SHEET-metal cable test and terminal boxes, of which 378 of various sizes were used, were manufactured by the W. R. Sykes Interlocking Signal Co., Ltd., of London, while Callender's Cable & Construction Co., Ltd., supplied signal cables. The completion of this line gives the Southern Railway the largest suburban electrified system in the world, as well as the first main-line all-electric Pullman service.

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Australian Fishery Needs Wire Netting for Oyster Beds

ACCORDING to an announcement in a London trade paper, an Australian company which grows oysters is anxious to get in touch with the manufacturers of wire netting suitable for submerging in salt water. This firm uses a considerable quantity of wire netting for the purpose of cultivating oysters on trays. The trays are placed out on banks about two feet off the ground, and have to stand a fair amount of rough usage from weather, weight of oysters and weed.

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THE firm states that for some time it has been using wire netting made in Australia, but has not found it altogether satisfactory, the Australian manufacturer being "unable to let us have it in 16 gauge or heavier, and do not make any in ⅜-inch mesh heavier than 17 gauge. We find this only lasts in our waters for a maximum time of 20 months, but with heavier gauge (16) in larger mesh we have had it last for as long as 2½ years. We would be glad if any manufacturers communicating with us would give their views on the matter, as this wire netting might, in their opinion, need to be heavier than 16 gauge."

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Novel Method of Supporting Cable Drums

A NOVEL method is described in a new British patent, recently taken out by the Compagnie Generale d'Electricite, of supporting very large and heavy cable and similar drums while the cable is being wound round them. A large tank has a vertical tubular member at its center and on this is mounted a floating tank which can slide up and down the tube. The drum to be wound is fixed to the floating tank and the main tank is filled with water or some other liquid. Adjustment of the vertical position of the drum is then effected by varying the level of the water on which its supporting tank floats by means of suitably placed taps. The floating tank is given the necessary rotary motion by means of a geared electric motor.

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British Revise Enamelled Copper Wire Standard Specification

SINCE the publication in 1922 of the first edition of the standard British specification for enamelled high conductivity copper wire considerable improvement has been made in the manufacture of this material with a corresponding improvement in the quality of the product. This development has been greatly assisted by the investigations carried out by the Electrical Research Association, and the results of these investigations have enabled a revision of the specification to be made.

It has, for example, been found possible to make the requirements regarding freedom from pinholes much more stringent than in the old specification. In addition, the

'Round the World With the Wire Industry

maximum permissible overall diameters of the enamelled wires have been slightly reduced, without any reduction in the severity of the high-voltage test. No minimum overall diameter is specified, since from the users' standpoint the thinner the enamel the better, provided the wire passes the electrical tests. The new revised specification has just been issued by the British Standards Institution.

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Famous British Works Manager Retiring

"BISHOP OF SILVERTOWN" has decided to retire. Behind this bare statement lies the fact that Benjamin George Bishop, one of the best-known figures in the British cable industry, has arrived at the end of a romantic career.

Mr. Bishop, works manager of the Silvertown Co., has been at the factory for 47 years. He was actually born at this historic rubber and cable works, his father having been with the same concern for 53 years—long before John Silver left Cornhill, London. In Silvertown they say of Mr. Bishop that it was he who made the world golfing mad by ousting the old gutty ball and making a better one, he who kept the troops in cigarettes during the war, he who fished up the German cables from the bottom of the sea, cut them and joined them up to Allied cables, and he who had a full view of the disastrous Silvertown explosion.

Although many people had a share in these things, behind them all was the indomitable personality of Bishop of Silvertown. Ever since the late John Silver started his factory on the Thames-side marshes, in the 'fifties, and built up Silvertown around the works, there has been a Bishop in the middle of things.

"We now make millions of golf balls annually," said Mr. Bishop in an interview. "When I first started we were making the old gutty ball. Then someone here had an idea and we produced an improved ball."

But for the improvement in the ball golf could never have been a popular sport. However, the introduction of the rubber ball sent the world golfing crazy, thereby proving the nucleus of an immense sporting equipment trade. Mr. Bishop confessed that he does not play golf!

About fishing up the German cables from the sea, he had a lot to say:

"First we cut the Emden-Teneriffe cable and towed one end into Brest harbor, cut the cable again near Casablanca, and then fixed it up as a Brest-Casablanca cable. We tapped it again a bit later and extended the cable to Dakar, Senegal. Imagine fishing for a cable in pitch darkness, the cable lying as far below the ship as is the Tower of London from Buckingham Palace (2½ miles). Imagine trying to cut it and haul up one of the free ends. Imagine pulling it up vertically through three miles of water, then steaming away while continuing to drag up the cable from the bottom, coiling it up, 1200 miles of it, without any kinks, and finally relaying it exactly where required."

"We had something to do with cigarettes, too", he added. In cigarette machines there is a special endless tape which curls the paper into shape and holds it firm while the tobacco is being pressed in. It is all automatic. Before the war all these tapes came from Germany. The cigarette concerns were at their wits end, stocks were running out; then one of our men had an idea and we were able to get new tapes ready just in time. So the troops got their smokes after all.

"Then I was near the works at the time of the great explosion. I was going home and saw it all. I went back to the works as quickly as I could."

Mr. Bishop went right back through the stricken district, not knowing if there would be another explosion. "But," explained a friend, "that is the way of the Bishops. Father and son, they have been doing it for 100 years."

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What Cold-Working of Metals Shows

IT has long been considered that where cold working of metals was possible better results were obtained than was the case where the more ordinary hot-working method was adopted. The density of the specific gravity is increased at the point of working, and the joint, rivet, or whatever it may be is rendered stronger. Actually, perhaps with the doubtful exception of a piece of metal compressed in a closed die, as in coinage making, the result of cold working is absolutely different from that usually supposed. As a matter of fact, the density and specific gravity are diminished and not increased.

Certain tests carried out go to show that the density of mild steel is diminished if it be subjected to compressive stress which leads to distortion. Others have shown that the density of steel and platinum wire is reduced by cold-drawing, and other experimentalists have demonstrated the fact that as a result of cold-rolling iron bars the density is rendered less than that of the untreated metal.

It has been pointed out that as the first result of pressure was to close up the surface pores, blowholes and cracks, an altogether erroneous impression of compactness is gained from a casual inspection; hence, bars usually appear more dense than do the ingots from which they are rolled.

Some little time ago a theory was propounded regarding this diminution of density, which explained both the increase in volume and the other curiously divergent characteristics. It appears that the permanent deformation of cold-worked metal is chiefly, if not entirely, due to the slipping of molecules along well-defined lines. There are

(*Please turn to page 91*)

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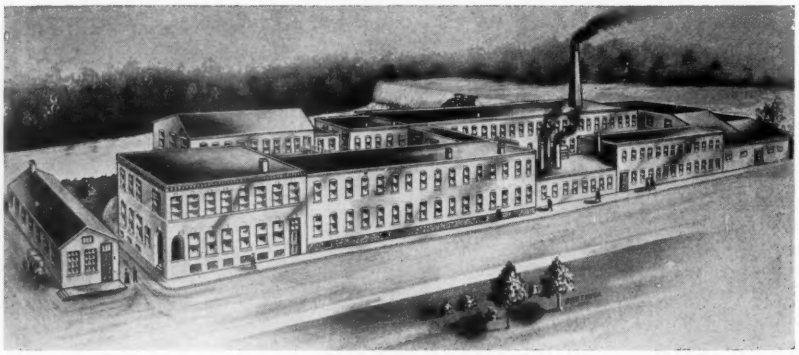

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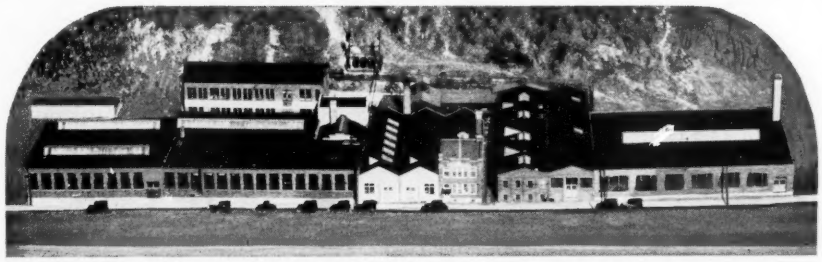

AERIAL VIEW OF PLANT OF HUDSON WIRE CO., OSSINING, N. Y. ▲ ▲ ▲
▼ ▼ ▼ FINE WIRE MANUFACTURERS ▼ ▼ ▼

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BRUSH WIRES, CRIMP and STRAIGHT

Brass, Steel, Nickel Silver, Copper and Phosphor Bronze

TINSEL LAHNS

Silver Plated Copper, False Gold and Copper

METALLIC FIBRE FOR PACKING PURPOSES

Copper, Bronze, Zinc, Lead and Aluminum

WIRES FOR METAL SPRAYING

Zinc, Tin, Lead, Cadmium, Copper, Bronzes, Nickel Silver, Aluminum and other wires to specification.

ROLLED FLAT WIRE WITH ROUND EDGES

Copper, Brass, Nickel Silver, Zinc, Lead, Phosphor Bronze and other wires to specification.

"Hudco" copper wire is drawn by the Hudson Wire Company of Ossining, N. Y., who have been specialists in the manufacture of fine wires for over thirty years. ▲

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Wire Questions and Answers

Question No. 1260--Where Can We Purchase Cimet Wire?

The Wire Association:

Will you kindly advise us where we can purchase Cimet wire? Your prompt attention to this will be appreciated.

Answer No. 1

The Wire Association:

In reply to your letter of July 25th, Cimet wire as I understand it is 24 to 30% Chromium and .21 to .35 Carbon. I believe this particular product is made by the Crucible Steel Company, 405 Lexington Ave., New York, N. Y.

Ascoloy 55 made by the Allegheny Steel Company of Brackenridge, Pa.; Unaloy 28.25 made by the Universal Steel Company of Bridgeville, Pa., and Halcomb .24 made by the Halcomb Steel Co., Syracuse, New York, are all duplicates of this wire and anyone of them would meet your requirements.

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Question No. 1271--Effect of Cold Drawing on Hardness and Physical Properties of Cold Drawn Wire

The Wire Association:

We would like to secure information and data as to what effect cold drawing has on hardness and physical properties of cold drawn wire.

Answer No. 1

The Wire Association:

Referring to your letter of August 26th regarding the effect cold drawing has on hardness and physical properties of cold drawn wire, the more wire is drawn cold the harder it gets and the more it is drawn the less elongation it has. In other words, what you do with wire drawing cold, is to increase the hardness and decrease the ductility.

Answer No. 2

The Wire Association:

We would suggest that you refer the questioner to Adam's Book on Wire Drawing in which this subject is very thoroughly discussed.

Answer No. 3

The Wire Association:

Answering your inquiry of August 26th, would say that the subject is entirely too large to cover in a letter.

In general, the hardness, tensile strength, and elastic limit are increased by cold drawing, while the capacity for elongation or ductility is usually reduced.

For anyone wishing general information covering the above subject, a good general reference would be a book by A. T. Adam on "Wire Drawing and the Cold Working of Steel", which can be obtained from the D. Van Nostrand Company.

Answer No. 4

The Wire Association:

Regarding your favor of the 26th, about 75% of our product is what we call our common stock, .12 to .16. The No. 5 rod has a yield point of 40,000 pounds to 45,000 pounds, tensile strength 55,000 to 60,000 pounds and elongation in 8" 23% to 28%. After being drawn one draft the yield point will be 70,000 pounds to 75,000 pounds, the tensile will increase to 80,000 pounds to 85,000 pounds and the elongation in 8" will be reduced to 6% to 8%.

After the second draft the yield point will be 90,000 pounds to 95,000 pounds, the tensile will go up to 97,000 pounds to 103,000 pounds and the elongation will still further reduce to 2% to 4% in 8".

After the third draft the yield point will be 110,000 pounds to 114,000 pounds, tensile 115,000 pounds to 120,000 pounds, and the elongation in 8" 1% to 2%.

After the fourth draft the yield point we have not been able to determine with our present testing machines, the tensile however will be 123,000 pounds to 130,000 pounds and the elongation will be less than 1%.

After the fifth draft the yield point we cannot determine, the tensile will increase to 133,000 pounds and the elongation less than one-half of 1%.

You may want to know about the drafts; we are taking the usual drafts from five to six hole wire that any ordinary commercial wire mill will take in either chilled iron or steel dies.

Lower carbon steel, that is, steel under .10, will have a little lower yield point, a little lower tensile and more elongation. Higher carbon steels will have the opposite, that is, it will be higher in yield point and tensile and have less elongation in 8".

We have never made a hardness test on cold drawn wire, but we know the hardness will increase with each draft.

If there is any further information we can give you, or if we can write to your principal regarding this, ask them to communicate with us direct and we will be glad to give any further information we are able to.

✦ ✦ ✦

Question No. 1276--Drawing Liquor Finish Bessemer Steel Wire.

The Wire Association:

We are wondering if it would be possible to furnish us with information on the proper method of drawing Liquor Finish Bessemer Steel from 17½ annealed to sizes .038 to .014. We are also interested in learning the method of figuring the percentage per draft.

We sincerely hope that you will be in a position to give us this information, and thank you in advance for any help you can give us.

Answer No. 1

The Wire Association:

The wire after annealing is usually cleaned in sulphuric acid and then dipped in a solution of copper sulphate and tin. This may be done either at the drawing frame or at the cleaning crane in accordance with local conditions. The wire is then put into barrels containing water to which about a pail full of sour rye meal liquor has been added and allowed to stand for several hours to eliminate the effect of the acid from the cleaning. The wire is then put into tubs containing water, a small amount of sour rye meal liquor and a solution of figged soap from which it is drawn, usually through steel dies, to the size desired. The ordinary draft at the start is from 20 to 25 per cent reduction in area and the subsequent drafts about 20 per cent. We have heard of more severe drafting being done but it is usually at the expense of the life of the dies. If you are drawing on continuous machinery, the coatings are a little different, but it is rather hard to give any definite formulae as conditions vary so in various plants.

With regard to the method of figuring the per cent reduction from one size to another: The usual way is on a slide rule which has four scales marked A, B, C and D. In order to calculate reduction in area place the "I" of C scale over original diameter of wire on D; run rider to size of wire desired on D; on B under rider line, read reciprocal of the percent reduction in area. This figure subtracted from 100 gives the per cent reduction. E. G.:—Drawing .080 to .040, placing the right hand on C over 8 on D, run the rider to cover 4 on D. This gives on B 25, the area remaining or 75 per cent reduction. Likewise from .080 to .050—we read 39 on B, or a reduction of 61 per cent. From .080 to some size like .020, say, we read on B 6.3, making the reduction 93.7%.

It is largely a matter of experience to determine just how heavy drafting can be used with the particular stock in hand, but a safe rule is that, except in coarse sizes, a maximum of about 30 per cent is all one can expect.

Answer No. 2

The Wire Association:

To draw from 17½ to No. 30 (.014") is a reduction in area of 92½% which is excessive for liquor drawn wire as the job will require ten drafts, which will cause the wire to loose its coating and either break or cut out. To draw .014 wet, the best practice would be to draw from No. 20 (.035") annealed as follows:

1st draft .0315 23% Reduction in area.
2nd draft .0275 23% Reduction in area.
3rd draft .024 23% Reduction in area.
4th draft .0215 20% Reduction in area.
5th draft .0195 18% Reduction in area.
6th draft .0175 18% Reduction in area.
7th draft .0158 18% Reduction in area.
8th draft .014 18% Reduction in area.

To draw from 17½ (.051) to .036"
1st draft .043
2nd draft .036

To know what percentage of reduction to take in any one draft can only be determine by experience, as various analysis of steel require different treatment. Bessemer wire can not be drafted as heavily as Basic, also high carbon

Wire Questions and Answers

wire, say 50% carbon, must be drafted differently from 10% carbon.

To figure the percentage of reduction in any one draft one must know the area of cross-section and then reduce the same by 20 or 25% or whatever percent of reduction one desires.

If we can be of any further assistance do not hesitate to call upon us.

Answer No. 3

The Wire Association:

With regard to information on the method of drawing Liquor Bessemer Steel, we believe two methods are in use, the proper one depending on the opinion of the party who may be responsible for the practice adopted.

Some people say the use of multiple block benches for single holding; such a machine being illustrated on page 8 of circular 735-W-2 herewith. We think the single hold process is in particular favor with those who prefer to use soft steel dies which are peened over and sized by hand.

For those who consider the use of diamond or tungsten carbide dies, continuous machines seem to have the preference and such machines of a size suitable for drawing the sizes mentioned in your letter are described in circular 834-W and 58-W.

We do not know that there is any particular method of figuring the percentage of draft. This depends upon the amount of reduction the wire will stand in the case of the single holding process, it being, of course, desirable to reduce the wire from the original size to the desired finished size in the least possible number of operations.

In the continuous machine the number of dies used is not of any serious consequence; therefore the drafting may or may not be as heavy as in the single holding process.

In the continuous machine the number of dies used is not of any serious consequence; therefore the drafting may or may not be as heavy as in the single holding process.

Inasmuch as the continuous machines as we ordinarily sell them for steel were designed primarily for non-ferrous metals, users of our machines generally follow Brown & Sharpe reductions where the material will stand such drafts. Where it will not, of course, it is possible to re-gear the machines to accomodate whatever drafts may be required.

We presume that your clients' understanding of Liquor Finished wire is similar to ours, that is, that the wire is first cleaned to remove any rust or lime coating that may have held over from the previous drafts, etc., dipped in the copper sulphate solution, washed in clean water, generally immersed again in the copper sulphate solution and washed again a second time, after which it seems to be the usual practice to place the coil in the tub of rye meal water and draw from this tub through whatever type of machine is use.

Answer No. 4

The Wire Association:

If they are drafting their wire on continuous machines, it must of course, be drafted to fit the fixed speed of the blocks. If they are drawing by single drafts, they will undoubtedly give the wire all it will stand in each draft without breaking or stripping its copper coat and they will be justified in doing so. It will stand considerably heavier drafting by the single draft method than by slip continuous machines.

If this were a case of dry drawing, I might have a good deal to say about drafting, but in wet drawing the matter is complicated by the presence of a copper coat which, if it is handled roughly, will peel off and plug up the die. The extent to which it will do this depends somewhat on the exact composition of the plating bath and the amount of copper plated on. These matters are left in the hands of the wire drawers whose experience is really the only guide we now have. What little experience I had had indicates that a light coat frequently renewed permits heavier drafting than any other practice.

The Wire Association is for the specific purpose of improving production methods. It was organized as a clearing house of ideas on technical problems and research work in all phases of practical wire drawing and wire working.

The following inquiries were received from and answered by members of the Wire Association. These inquiries are sent to the Secretary of the Association who acts as a central clearing point, and neither the names of the firms or individuals sending in the inquiry, or of the men or firms replying are divulged without permission.

Join the Wire Association!

✦ ✦ ✦

Question No. 1240—Information on the Use of Spelter Wanted

The Wire Association:

There is one thing I have been intending to write you about for some time and that is this:

We use Electrolytic spelter in the wire mill and in the sheet mill we use Prime Western. Would it be possible for you to put out a questionnaire and ask some of the other independents whether they use Prime Western, Electrolytic or Horsehead on ordinary common wire products such as fence, barb wire, etc.? Are they able to get four-minute wire on Prime Western spelter as easily as they can with Horsehead or Electrolytic, and any other information they would be willing to put out about the grades of spelter. In the meantime we will supply any information we can about the use of Electrolytic if you want it.

Answer No. 1

The Wire Association:

The use of high grade spelters in galvanizing wire has been limited to a great extent to such uses as telephone wire and some heavy costs. Recently, however, the rapid changes in the technique of galvanizing wire and also the changes in equipment have eliminated the necessity of using high grade spelters on any wire galvanizing. It is possible with the proper type of acid and bath technique and the proper type of installation to obtain excellent results on certain grades of fluid Prime Western. None of my plants at the present time are paying a premium for high grade spelters on any type of wire, even telephone wire.

Answer No. 2

The Wire Association:

With reference to your inquiry of April 18th, regarding the use of Electrolytic, Prime Western and Horsehead Spelters, we would advise that we do not use Electrolytic Spelter in any of our departments. Prime Western is used only in the commonest grades of wire and wire products; and, where special emersions are required, such as telephone wire, snow fence wire, special railroad fence, chain link fence, etc., it is practically impossible to get the proper quality without the use of Horsehead or Electrolytic Zinc.

I have noticed in my contact with the various plants, that Electrolytic Zinc is used almost entirely in connection with the process known as Galvanneal used by the Colorado Fuel & Iron Company, and Keystone Steel & Wire Company.

Your inquiry refers to the manufacture of "four minute wire", using Primer Western Spelter. This term "four minute wire" does not mean very much unless the specific gauge of wire is mentioned for as you know in the lighter gauges it is impossible to get a four one-minute wire.

Answer No. 3

The Wire Association:

We have had no experience in the use of Electrolytic spelter. The most usual practice at present is to use Prime Western for ordinary galvanized wire and to use the purer grades, such as, Horsehead, Bertha and so forth for such types of wire as rope wire, telephone and telegraph wire, and tie wires, on which more or less severe bending tests are required. We have no information as to the relative ability of the same weights of Prime Western and other grades of spelter to stand the Preece test and would appreciate information ourselves as to this condition.

Answer No. 4

The Wire Association:

We do very little galvanizing, in fact, only attempt to handle the smaller gauges as we are not in a territory where there is much demand for Galvanized Wire for automatic machine use.

We use Horsehead Spelter exclusively for such galvanizing as we have to do as we feel that with our limited capacity we want to use the highest grade spelter

obtainable and in our opinion this is the Horsehead brand.

If you want to secure more information about spelter and galvanizing, we would suggest that you take the matter up with Mr. John Mordica, Supt., of the Sparrows Point Works of the Bethlehem Steel Company, who manufactures more Galvanized wire in one week than we could make in a year.

Answer No. 5

The Wire Association:

Referring to your letter of April 26th regarding the use of different kinds of spelter.

We make light and heavy coated galvanized wire. The heavy being four and four and one-half minute wire, the light for barbed wire and fence etc. We use Prime Western on the light coated wire and Horsehead on the heavy. We have found that while it is possible to make four minute coating with Prime Western, it is much easier to do it with Horsehead and also to do a better job.

Our experience with Electrolytic is that we could not get a smooth finish as with Horsehead. The only zinc that we have had that gave as good results on four minute wire as Horsehead was Evan-Wallower zinc. We have found that light coated wire can be made from any of the above mentioned zincs.

Answer No. 6

The Wire Association:

Replying to your letter of April 26th, we use in all our wire work the Electrolytic Zinc, having ceased the use of Prime Western some months ago. We feel confident that a better wire results from the higher grade zinc.

With regard to the "Four minute wire", it seems to us that it is easier to get the "four minute" coat, and it certainly has less tendency to flaking and cracking.

✦ ✦ ✦

Question No. 1262---Baking Low-Carbon Wire and Rods

The Wire Association:

We are desirous of obtaining comprehensive information as to the practicability of baking low carbon wire and rods for 30 to 60 minutes instead of several hours. We would like to know the objections if there are any from a metallurgical and practical standpoint. Can you help us?

Answer No. 1

The Wire Association:

Answering your letter of August 2, would say that we believe this would be entirely practical.

The original purpose of baking was to remove embrittlement in Bessemer and high carbon steels caused by hydrogen absorption during the pickling operation. Inasmuch as the hydrogen absorption in soft steel is negligible it is only necessary that the rods with their coating, be thoroughly dried before drawing. Therefore, if the baker is so designed as to do a thorough drying job in 30 to 60 minutes, this is all that is necessary.

Answer No. 2

The Wire Association:

Referring to your letter of August 2nd regarding baking low carbon wire.

As far as I know, from a Metallurgical and practical standpoint, the short length of time one could leave wire in the dry house (Baker) the better it would be, because the short time in the dry house would indicate that the acid had not attacked the steel and after all this is where the trouble comes from. If good results are obtained from short baking, no harm will be done. It is only necessary to bake wire a long time when the wire has been in the acid long enough to penetrate the material.

Answer No. 3

The Wire Association:

Your letter asking for information or suggestions regarding the length of time for Rod Baking has been received.

My opinion is that there is no definite time for the baking of Rods. The only thing necessary is to bake them until they are entirely free from moisture, and the length of time depends on what is carried in the bakers, and to some extent the heat of the line shaft, and how heavy the lime coating is, however, these two items are rather minor.

We carry our bakers at about 400 degrees temperature, and they are of sufficient capacity so that we do not have to pull Rods from them until they have baked about three hours, however, we have had occasions where we have taken out Rods in one hour.

On some of the light coated Rods for bright finishes, twenty or thirty minutes is sufficient time.

Answer No. 4

The Wire Association:

In the final analysis, every company has to determine for themselves the length of time that baking requires. In the first place, if the company is using a good inhibitor in their acid, the time required for baking will be very materially reduced, and again if the wire or rods are allowed to hang freely in the baker leaving the individual strands more accessible to the heat, the time required will be cut down, and if they use an exhaust system on their baker, thus taking out the gases and supplying fresh air continuously, this will cut down the time of baking.

The time of baking is really determined by the future processes, i. e., the baking has to be of sufficient time to remove the hydrogen absorbed by the steel, so that the wire will draw properly by the steel, so that the wire will draw properly through the dies without scratching, and when the wire is finished, it will have to meet the tests set for that particular wire.

It has often been found, especially in low carbon wires, that wire sent out from the mill would not run through automatic machines used by the wire goods manufacturers, but if this same wire is allowed to remain in stock for a period of time, it then runs through these machines satisfactorily. The theory is that the hydrogen leaves the wire at normal temperatures if the time is sufficient.

It is apparent, therefore, that baking is simply a time temperature (within limits) proposition and, of course, the time depends somewhat upon the amount of hydrogen absorbed in the pickling operation. We are baking some of our rods for as short a period as half an hour.

✦ ✦ ✦

Question No. 1260---Unit of Sale for Barbed Wire

The Wire Association:

Do you have any information that indicates whether the manufacturers of barbed wire are experiencing any tendency toward, or away from the 80 rod spool of barbed wire as the unit of sale?

Answer No. 1

The Wire Association:

Replying to your inquiry of August 2nd, will advise that the 80 rod spool of barbed wire appears to be very firmly established and we can see no tendency to get away from it.

It is the writer's belief that over 90% of the barbed wire sold is in 80 rod spools.

Answer No. 2

The Wire Association:

Regarding your favor of the 1st, so far as I can notice the demand for this is just like it always has been. I wish to say that the 80 Rod Spool still predominates as the unit of sale on Barb wire. It is true the trade in some sections of the country prefer 100 pound or catchweight spools but taken as a whole orders calling for such packing are greatly in the minority and so far as I can see there are no evidences of a decline in the popularity of 80 Rod spools. Nor on the other hand is there any marked tendency on the part of dealers and consumers who have heretofore purchased Barb Wire in 80 Rod Spools to change over to the 100 pound or catchweight spools.

Answer No. 3

The Wire Association:

With reference to your letter of August 2nd, concerning the tendency toward, or away from 80-rod spools in the sale of barbed wire—I am told that our general practice has always been to sell this on bucks containing approximately 1000 feet. We do, however, furnish the material on 80-rod spools when desired.

Answer No. 4

The Wire Association:

Our experience is that 70-80% of our (this means tonnage) customers demand 80 rod reels. We believe more 80 rod reels are sold now than a few years ago.

Answer No. 5

The Wire Association:

In regard to the inquiry of August 1, concerning barbed wire, would say that my experience has been that the tend-

Wire Questions and Answers

ency has been very definite toward the 80 rod spool as the unit of sale, although the mills are furnishing catchweight spools where the customer desires them.

Answer No. 6

The Wire Association:

According to our analysis there is no tendency on the part of Barb Wire manufacturers to deviate from the standard 80 rod spool size.

We, of course, still manufacture catch weight spools weighing 100 lbs. each, and these two sizes are considered as standard by us as they constitute the only sizes that we sell for domestic use.

Answer No. 7

The Wire Association:

There does not seem to be any change in the Western territory in the relative proportion of 80 rod spools of barb wire consumed by the trade as compared with sales over the last few years.

Answer No. 8

The Wire Association:

Your letter from a Member received, and must say that we had this question raised on why this practice is being kept up, however, I personally feel that this is going to be a unit of sale for quite some time, and I see no reason for changing.

Farmers' fields are divided in ten, twenty, forty or eighty acres usually, and this is the reason for this practice, and if eighty rods of Barb Wire is not the proper unit of sale, then in my opinion twenty or forty rod rolls of Fence should not be units of sale in the Woven Fence line.

I cannot, therefore, see any good reason why the unit of sale for barb wire should be changed.

Answer No. 9

The Wire Association:

Referring to your letter of August 1st, regarding barbed wire spools please be advised that it is about a 50-50 basis between 80 rod and catchweight spools on barbed wire. We do not see that any change is taking place. Of course, export trade is nearly all small spools.

Answer No. 10

The Wire Association:

We have noticed no indication of a tendency toward or away from the 80 rod spool of barbed wire as a unit. The only apparent tendency in the preparation of barbed wire is that the so-called catchweight reels of barbed wire are being required more and more in exact 100 pound weights, but our percentage of 80 rod spools has not deviated in the last 10 years.

Answer No. 11

The Wire Association:

We wish to advise that for some time past the greater portion of our sales of barbed wire have been in 50 and 100 ft. coils rather than the 80 rod spools.

✦ ✦ ✦

Question No. 1279--The Tinning of Refrigerator Trays

The Wire Association:

We are having considerable trouble with the tinning of refrigerator trays. These trays are made from No. 5/16 and No. 11 wire and then tinned, must stand a 24 hour salt spray solution, the solution being fifty percent by volume, or fifteen percent by weight. We would like to have the following information:

(1) In the tinning of articles of this nature, which is the better cleaner to use, what percentage of mixture and also temperature?

(2) After coming out of the cleaner, should the article be rinsed in clear water prior to pickling?

(3) Which is the better pickling solution to use for tinning, sulphuric or muriatic, what strength of solution and what temperature? Also after coming from the pickling solution, should the articles be again rinsed in cold or clear water, before entering the tin bath?

(4) Should clear virgin tin be used or should there be a certain percentage of lead in this tin, and if so, what percent is recommended? Also what temperature should the tin be kept.

(5) How many ounces of tin, per square foot of surface is necessary in order to stand the above salt spray solution?

Can you give us any information on this matter? Your early reply will be greatly appreciated.

✦ ✦ ✦

Answer No. 1

The Wire Association:

Our metallurgist has requested that we give you the information regarding the tinning of refrigerator racks asked for in your letter of October 5th.

1. Cleaner. Oakite compound No. 30. Oakite Products Inc., N. Y.
   Percentage. 4 oz. cleaner to gallon water temperature. 212° Fahrenheit.
2. Cleaner Rinse. Cold water.
3. Pickling. Muriatic Acid.
   Strength solution. 90% acid 10% water.
   Temperature—Cold.
4. Alloy of lead and tin recommended, as alloy is harder than Virgin Tin, and will, therefore, stand up better under salt spray.
   Brinell hardness Virgin Tin 4.0.
   Brinell hardness 50% tin 50% lead 15.0.
   It should be remembered that the higher percentage Lead used the more will be the discoloration if alloy is rubbed on clean surface.
   We have found an alloy of 75% tin and 25% lead by weight is most satisfactory. The addition of lead also has the advantage of lowering melting point.
   Temperature of Tin Bath.
   75% Tin 25% lead (by weight)—560° Fahr.
   100% Tin—530° Fahr.
   (Note: Over 530° Virgin tin takes on yellow tint).
5. Ounce tin per sq. ft. of surface necessary for twenty four hour salt spray. It must be remembered that, in hot dip process where wiping is not practical, it is impossible to get uniform thickness of plate, due to unequal lengths of tin flow. With alloy of 75% tin 25% lead by weight, there will be a variation of from .333 to 1.0 oz. per square foot of surface covered. Either thickness of coating should stand 24 hour salt spray test.

Answer No. 2

The Wire Association:

Re your inquiry of September 30th it is practically impossible to furnish a tray dip tinned that will withstand any great length of time in the salt spray. A great many specifications call for pure tin to be used and in these cases, of course, it is impossible to substitute any terne mixture. If however this should be allowable, a mixture of 60 per cent tin and 40 per cent lead is quite satisfactory and will stand up longer under the salt spray. Muriatic acid is the best cleaner, the routine being to clean in muriatic acid, wash in water, dip in a flux of zinc chloride and then directly into the tin. The cleaning bath should be about 10 per cent acid and the zinc chloride solution about a 30 degree Beaume. We have no figures as to the weight of the coating and if the rods were weighed before and after tinning to establish this weight, it would be inaccurate on account of the excess amount of coating left at the junctions of the wires.

Answer No. 3

The Wire Association:

Personally, I don't believe that test is always a true measure of how an article will stand up in service.

We use a muriatic acid solution, cold, approximately 10% for much of our cleaning, before tinning, though it depends on the condition of the wire surface.

Your inquiry speaks of a "cleaner" and also a "pickling solution". Just what the distinction is, is not clear.

With the wire cleaned, it is then dipped in a flux of zinc chloride to which

(*Please turn to page 91*)

A Review of Recent Wire Patents

No. 1,893,119, CABLE FOR COMPARATIVELY DEEP SEAS, Patented January 3, 1933, by George Zapf of Riehlerwall, Cologne, Germany, assignor to Felten & Guilleaume Carlswerk Actien-Gesellschaft of Cologne-Mulheim, Germany.

This cable construction includes a pressure protecting covering made up of aluminum profile wires having their sides partly in intimate contact and partly formed with recesses lying opposite each other, steel wires of specially high tensile strength inserted in the recesses formed in the sides of the profile wires and a lead covering surrounding each of the steel wires.

✦ ✦ ✦

No. 1,893,266, ELECTRIC CABLE, Patented January 3, 1933, by Mario Barberis and Ugo Baggi of Turin, Italy, assignors by mesne assignments to S. I. R. T. I. (Societa Italiana Reti Telefoniche Interurbane) of Milan, Italy, a joint-stock company of Italy.

Particularly, the invention relates to a protected coating for wire cables to protect them against the injurious action of transient currents and of acid substances contained in the ground. The cable is provided with the ordinary lead sheath and surrounding this is a layer of neutral bituminous material with an insulating rubber band wound around this layer and a water-tight paper tape wound on the insulating band with a bitumen layer on the paper tape.

✦ ✦ ✦

No. 1,893,376, HIGH TENSION POWER TRANSMITTING ELECTRIC CABLE, Patented January 3, 1933, by Carl A. Piercy of Ballston Lake, New York, assignor to General Electric Company, a Corporation of New York.

The inventor states that he has discovered and confirmed by tests that by suitably preparing the edges of the tapes or ribbons of insulating material used in high tension power transmitting electric cables, the possibility of voids occurring between them is reduced to a marked degree. He provides a spirally wrapped tape insulation around the conductors, with small clearance between turns, the tape having a hard surface central body and a fuzzy edge, the fuzz on the edge serving to restrict the movement of impregnating fluid in the clearance between the turns.

✦ ✦ ✦

No. 1,893,495, PROCESS FOR MAKING COATING MATERIALS FOR DEOXIDATION OF RUST, Patented January 10, 1933, by Rudolf Eberhard of Munich, Germany.

For the above purpose, the inventor provides coating the rusty surface with a solution of a tungsten compound (tungstic anhydride, or the like) in a mixture of uric acid and formaldehyde.

✦ ✦ ✦

No. 1,893,590, METHOD OF INSULATING WIRE, Patented January 10, 1933, by Edward A. Mau of Arlington, New Jersey, and Orrin F. Hutchinson of New Haven, Connecticut, assignors to Rockbestos Products Corporation of New Haven, Connecticut.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

Particularly, the invention relates to the manufacture of magnet wire and provides for a very thin insulating covering. In the process the inventor draws the conductor thru an adhesive mixture, then disposes it beneath a sliver of fibrous material and then with the fibrous sliver between a pair of cooperating forwardly moving and transversely agitating belts, causing the fibers adjacent the conductor to be emebedded in the adhesive thereon, after which the conductor is passed between a pair of cooperating rotating wiping members to compact the fibers together. After this the same is passed thru a bath of fiber lining compound and then passed between a pair of cooperating rotating polishing members to further compress the fibers of the covering.

✦ ✦ ✦

No. 1,893,830, WIRE FABRIC, Patented January 10, 1933, by Robert P. Turner of York, Pennsylvania, assignor to New York Wire Cloth Company of New York, N. Y., a Corporation of Delaware.

The strands comprising this wire screen cloth have a strength-providing aluminum alloy core and a corrosion-resistant outer surface of aluminum, the coating of the separate strands adhering where the strands cross to produce a stiffening effect upon the cloth.

✦ ✦ ✦

No. 1,394,447, STEEL WOOL MACHINE, Patented January 17, 1933, by William H. Robbins and Raymond F. Boehler, Jr., of Springfield, Ohio, assignors to The Williams Company of London, Ohio, a Corporation of Ohio.

The inventor provides a steel wool machine adapted to employ a single continuous wire which passes thru the machine once only and which is cut down to the minimum size after having passed thru the machine, at which time it is cut off in sections. New lengths of wire are supplied to the machine by welding, or otherwise, attaching the wire to the end of the old wire as it enters the machine, in particular, a machine is provided having a number of loops of the single wire, these loops being arranged in groups and each group being spanned by a common cutting tool or group of cutting tools. Also see Reference 1,894,448.

✦ ✦ ✦

No. 1,894,703, WIRE STRAIGHTENING APPARATUS, Patented January 17, 1933, by Robert C. Pierce of Niles, Michigan, assignor to National-Standard Company of Niles, Michigan, a Corporation of Michigan.

This apparatus is stated to be particularly applicable to removing bends from wire employed in the manufacture of reinforcing elements for tire beads. The apparatus is stated to be adapted to straighten the wire so that it will lay out flat in long lengths. The inventor also provides a haul-off drum or wheel having a diameter large enough so that after the wire is pulled thru the straightening rollers, it will not again be given another permanent curvature or bend because of its wraps around the haul-off drum.

✦ ✦ ✦

No. 1,894,756, WIRE ROPE AND STRAND PREFORMING DEVICE, Patented January 17, 1933, by David W. Clark of Montreal, Quebec, Canada, assignor to John A. Roebling's Sons Company, of Trenton, New Jersey, a Corporation of New Jersey.

A special object of the invention is to provide means for preforming the wires or strands of a cable, so that their free ends will not unravel. The construction includes a fly and a head secured to a spindle rotatably mounted, a central disc secured to a support rotating with the head, other discs on opposite sides of the central disc slidably secured to this support and intermediate discs slidably secured to the support between the outer discs and the central disc and adjustable in the circumferential direction thereof, wire crimping rollers being disposed on the periphery of each of the discs.

✦ ✦ ✦

No. 1,895,568, RUST PROOFING IRON AND STEEL ARTICLES, Patented January 31, 1933 by Leo P. Curtin of Cranbury, New Jersey, and Bernard L. Kline of Brooklyn, New York, assignors to The Western Union Telegraph Company of New York, N. Y., a Corporation of New York.

The process in this invention comprises subjecting a clean metallic surface to the action of a solution containing from one per cent to about ten per cent of oxalic acid dihydrate and a relatively small amount of an agent serving to accelerate the formation of the coating of the group consisting of sulfuric acid in a ferric salt at a temperature from about normal atmospheric temperature to about 100° C. for at least about five minutes until the coating of the desired thickness is formed thereon.

✦ ✦ ✦

No. 1,895,828, WIRE SPLICING MACHINE, Patented January 31, 1933 by Charles L. Van Inwagen, Jr., of Rutherford, New Jersey, assignor to Bell Telephone Laboratories, Incorporated, of New York, N. Y., a Corporation of New York.

Particularly, the invention relates to a machine for splicing multi-conductor cables and a feature thereof is the provision of means for removing the pigtail joint from the index pin or finger about which it is placed during the twisting operation and for folding the joint into alignment with the wire of which the joint is a part. This means is capable of folding the joint in either direction depending upon the position of a member which is manually thrown prior to the twisting operation. This enables a better distribution of the pigtails or joints than if they were all folded one way.

Exports and Imports of Wire

Exports of iron and steel wire products in November and December, 1932
(In gross tons)

	December 1932	November 1932	December 1931
Wire rods	1,103	472	2,162
Hoops, bands and strip steel	892	1,276	1,612
Plain black or galvanized iron or steel wire	731	404	978
Barbed wire and woven wire fencing	1,348	904	1,630
Woven wire screen cloth	43	51	47
Wire rope	123	107	180
Insulated iron or steel wire and cable	2	2	22
Other wire and manufactures	194	167	340
Wire nails	701	711	1,161
Tacks	41	30	81
Other nails, including staples	270	219	275
Bolts, machine screws, nuts, rivets and washers	307	206	284
Total, these 12 classifications	5,755	4,549	8,772

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement bars	905	1,474	2,030
Hollow bars and drill steel	73	103	51
Merchant steel bars	1,711	3,150	4,564
Wire rods	1,149	935	662
Barbed wire	521	1,876	1,675
Round iron and steel wire	105	102	118
Telephone and telegraph wire	3	2	3
Flat wire and strip steel	91	131	96
Wire rope and strand	146	148	165
Other wire	123	243	24
Hoops and bands	1,777	2,741	4,250
Nails, tacks and staples	1,051	1,199	335
Bolts nuts and rivets	26	33	5
Total, these 13 classifications	7,681	13,137	13,978

THE export trade in December was 1,923 tons smaller than that of November. Changes in the volume of the trade in individual items, whether gains or losses, were in relatively small amount — one gain, of 1,843 tons in tin plate, and one loss, of 1,843 tons in skelp, being the only instances where a figure of 1,000 tons was exceeded. One other gain, of 631 tons in wire rods, was of interest, however, as were two other instances of losses —of 835 tons in casing and oil line pipe and of 620 tons in black steel sheets. The chief products in the month's trade were scrap, tin plate, black steel sheets, and welded steel pipe in that order.

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THE Far East was the United States' best market in December, 48 per cent of all shipments going to that area in that month, Europe and the countries of North and Central America and the West Indies each took 22 per cent, while South America and Africa took 7 and 1 per cent, respectively.

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JAPAN was the largest individual market in December, taking in all 19,268 tons of iron and steel from this country including 17,199 tons of scrap, 998 tons of wire rods, and 982 tons of tin plate. Next in rank was Canada with a total of 6,730 tons of which scrap accounted for 2,126 tons. Italy and Poland, the third and fourth markets of the month, took 6,199 and 4,350 tons respectively, all of which was scrap. The trade with the Philippine Islands—2,736 tons—included 372 tons of wire nails. The Chinese total of 2,201 tons included 1,228 tons of tin plate.

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DECREASES outnumbered increases 2 to 1 in the December import trade in iron and steel products. Only 1 increase of significance was recorded—that of 5,468 tons in pig iron—while there were reductions of 2,431 tons in sheets, skelp and sawplate, of 2,327 tons in ferro-manganese, of 1,489 tons in structural shapes, of 1,439 tons in merchant steel bars, and of 1,355 tons in barbed wire included in the 22 decreases reported. The trade as a whole declined 5,534 tons and totaled only 29,390 tons.

THE chief supplying country in the import trade in December was the Netherlands whose total was 6,655 tons. Following came Belgium with a total trade amounting to 6,491 tons including 904 tons of concrete reinforcement bars, and 824 tons of merchant steel bars. The shipment of 5,861 tons of pig iron contributed the principal part of the British total of 6,404 tons, while the trade with France (3,067 tons included 770 tons of hoops, and that of Germany (2,961 tons), 1,034 tons of nails and 469 tons of wire rods.

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RECEIPTS of card clothing declined to 8,421 sq. feet valued at $7,156—8,407 square feet ($7,134) coming from the United Kingdom and the balance from Germany.

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WIRE cloth and screening imports were also sharply reduced and totaled only 6,392 sq. feet of which 3,997 square feet came from Canada, 1,750 square feet from Germany and the balance from France.

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FOURDRINIER wire receipts were slightly greater at 68,527 sq. feet of which quantity 19,411 square feet came from Germany, 18,918 square feet from Austria, 15,776 square feet from Sweden, and 14,422 square feet from France.

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IMPORTS of wire fencing and netting were larger in December —that galvanized before weaving totalling 2,005,650 square feet (1,797,900 square feet from Germany and the balance from Belgium) and that galvanized after weaving 1,202,200 square feet (1,266,200 square feet from Germany and the balance from the Netherlands.

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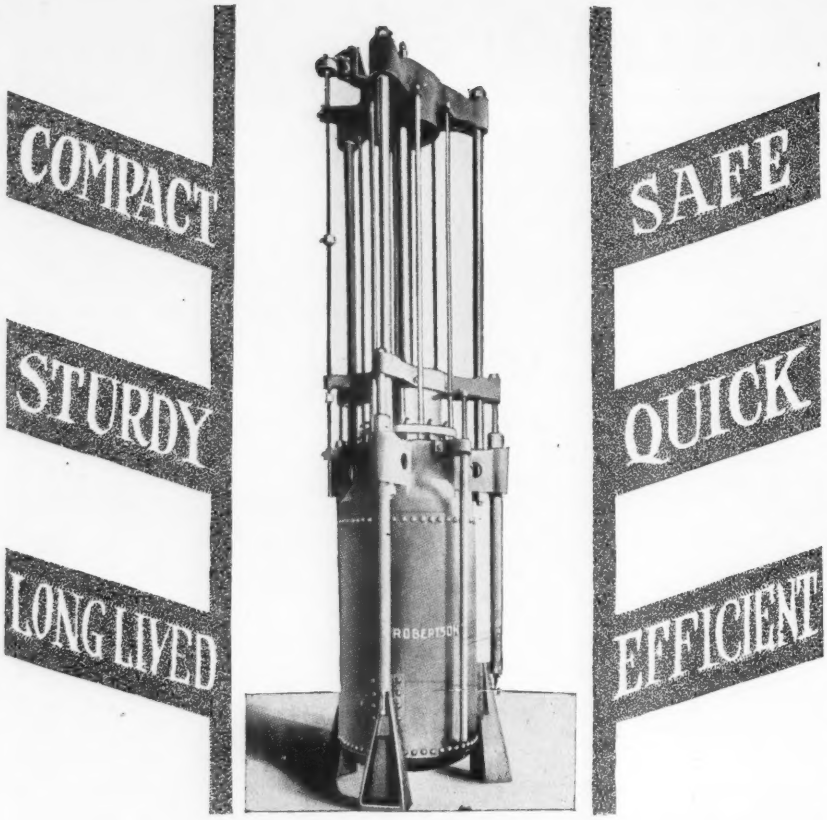
WIRE heddle receipts suffered a further decline—to 1,233,000 pieces of which France supplied 1,128,000 and Germany 105,000.



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John ROBERTSON CO. INC.

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A New Device For the Estimation of Zinc Coats

(*Continued from page 76*)

coatings than the Preece. After reading the results on the graduated tube the sample can be allowed to drop out at the lower stopcock, and its diameter can be measured and the character of its surface determined. The apparatus is then ready for another test.

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IT will be seen at once, from the description of the device that it can be set up in the galvanizing shop, close to the take-up blocks, to be operated by unskilled labor. The blocker or the trucker can make the determination at any desired spot, with very little instruction.

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AS will be clear from the above description, the principle of the process depends on the fact that the reaction tube and the measuring burette are combined into one, and that the acid of the reaction acts as a gas-seal. It is this construction which makes it possible to use such a compact and rugged device, and to escape errors always threatening when gases are to be conveyed and measured.

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THE calculation from gas volume to zinc weight depends upon the fact that the hydrogen evolved during the solution of a metal in acid bears a fixed relation to the amount of metal. The factor, referred to the molecular weight of any metal, is 22.424. From 65.38 grams of zinc there will come 22.424 litres of hydrogen. Conversely, if at 0° centigrade and 760 millimeters pressure, 22.424 litres of hydrogen are given off, we have dissolved 65.38 grams of zinc. One cubic centimeter of gas corresponds to

$$\frac{65.380}{22.424} = 2.91$$

milligrams of zinc. If this factor is multiplied by the quantity of gas given off, the answer is the amount of zinc in milligrams, and as the amount of surface is easily determined we have the weight of zinc per unit of surface.

FOR these calculations the factor needs to be corrected because the test is always made at room-temperature, about 68° Fahrenheit, and as gases expand with heat, the volume increases. The factor should therefore be reduced, and if it is taken as 2.72 it is found that the readings agree very well with a large number of check analysis. This is the factor used in the Cushmans test, as it is already tried and proven correct.

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A further small correction ought to be made because the gas is not dry, but is measured while in contact with the sealing liquid; further, there might be corrections made for the barometer reading; but these are too small to bother with, especially as we do not make corrections for slight differences in the composition of the coating. With regard to this last, it is to be noted that the impurity present in greatest quantity, iron, affects the factor only slightly, while lead, which would have a quite different factor is present only in very small amounts, so that these variables can be ignored. This factor, therefore, is figured on a basis of pure zinc; if there happens to be an unusual amount of lead in the coating, the test will indicate rather less zinc than a chemical analysis will show, so that errors due to impure zinc will be in the direction of indicating less zinc than there really is.

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A critical research into the limits of error of this test will soon be published elsewhere, so any farther discussion of the point at this time would be superfluous.

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THE accuracy of this gas test, as well as of the analytical test, is limited by irregularities in the coating itself as carried on the chosen sample, irregularities such as are always likely to occur. Such variations are of the order of 3 to 10 per cent, which is a much wider range than any possible error inherent in the test itself.

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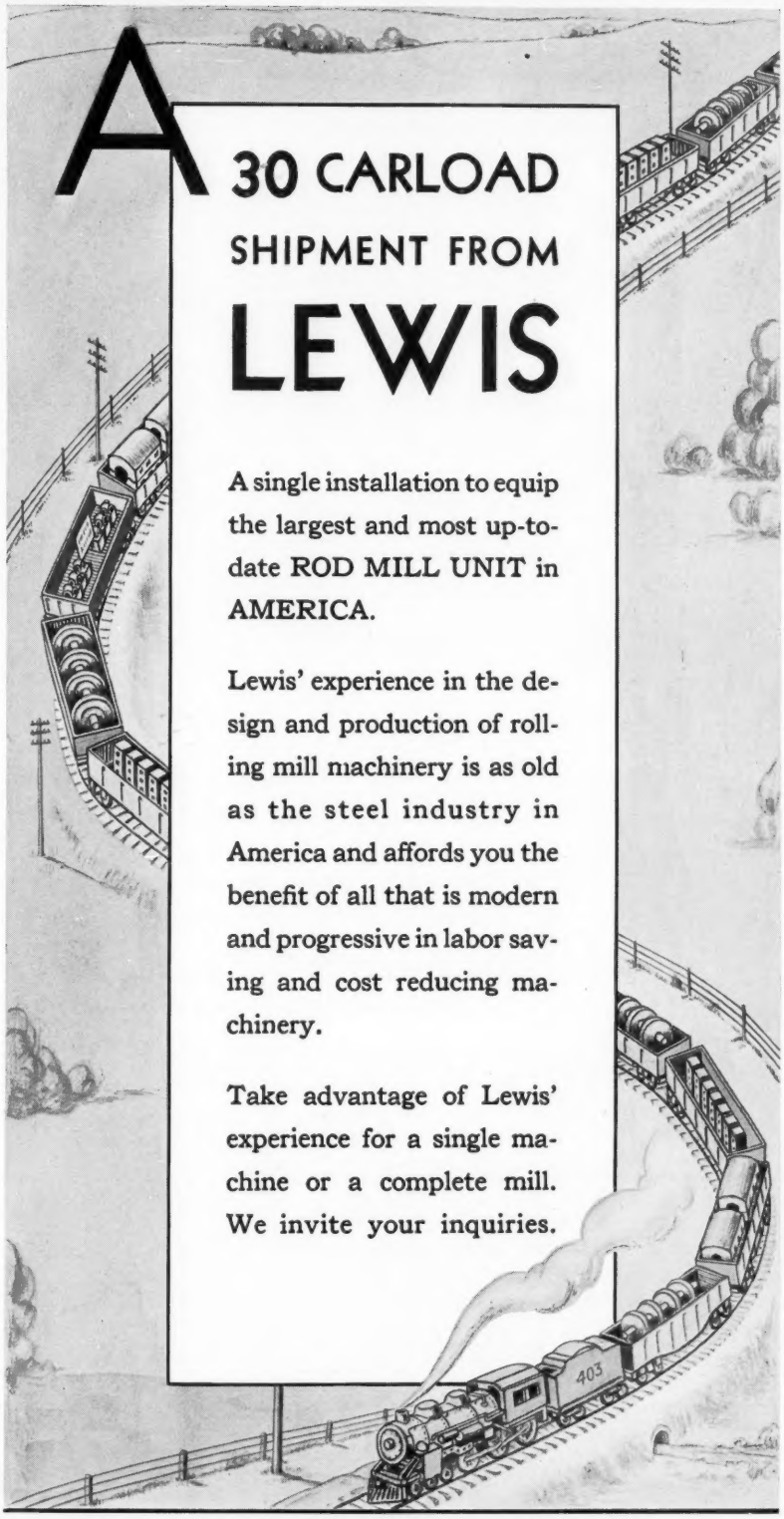
SO, as stated for practical work with this testing device, a factor of 2.72 may be used, without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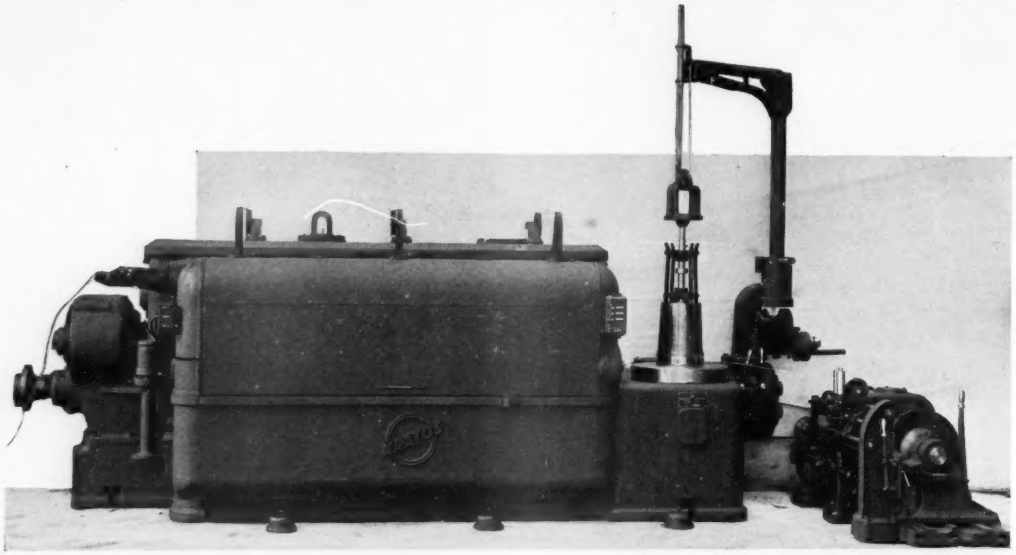

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further correction, and in case exact figures are desired, a factor of 2.91 with corrections in the gas volume for temperature and barometer.

✦ ✦ ✦

WITH the factor as established each volume of gas evolved corresponds to a definite amount of zinc per unit of surface of the sample. Needless to say, the conversion tables should be so prepared as to read directly in grams per square meter, or other desired unit, from the observed gas volume.

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✦ ✦ ✦

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WHY DON'T YOU JOIN THE WIRE ASSOCIATION:

ADDRESS THE SECRETARY

Richard E. Brown, 17 East 42nd St., New York, N. Y.

'Round the World With The Wire Industry

(*Continued from page 79*)

certain planes of internal crystal symmetry, and the particles, pushed apart, slide along these, the material between being left in a state of tension.

In a piece of cold-worked metal these planes cross and recross each other, the result being as though a reinforcement of shapeless and non-crystalline material had been wound in and around these planes, and consequently strengthening the metal.

It was suggested some time back that hardness corresponds with a condition of internal tension, while softness was seemingly dependent on its absence. This serves to support the conclusion, long since arrived at by practical steelworkers, that the hardening of iron is caused by the particles of metal being forced apart and held in a unnatural condition, after the distorting heat had been applied, by quick quenching.

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Wire Questions and Answers

(*Continued from page 85*)

has been added a small amount of sulphuric acid. We use no water dip tin to say so.

We use pure "straits" tin. Some time ago we tried various percentages of lead up to 50% on some wire and exposed the various samples to the weather with not enough difference from pure tine to say so.

Our practice is to keep the tin temperature as low as possible in order to keep amount of dross down and to get a bright finish. A too high temperature is apt to give a yellow tinge.

Trust the above may be of some help.

Answer No. 4

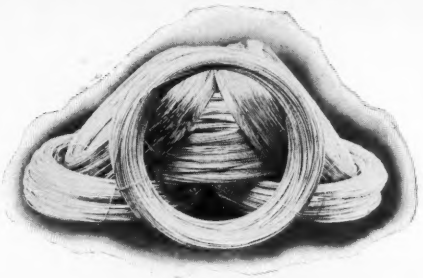
The Wire Association:

The questions as asked by you will be taken up in sequence as numbered and while we cannot answer all of them with supporting data, which by the way does not exist, our opinion is offered.

1. Steel requires a strong alkali cleaner whether it has grease and oil upon it, or ordinary scale. Greases and oils must be removed and can be successfully done in a compounded cleaner. The oils are nearly always mineral oils and they are not soluble in a straight caustic alkali; they must first be emulsified and this can be removed. By the use of a cleaner compounded for such conditions, both operations can be accomplished in the same solution.

The percentage of mixture used must be determined by a study of each particular problem. A universal oil or grease or any protective coating is not used and

SILVER BRIGHT GALVANIZED



We furnish this highly finished galvanized wire to meet your requirements as to coating, tensile strength, bend test, etc. Packed in coils or straightened and cut to length. Our organization will be glad to offer its long experience in wire problems toward the betterment of your product or a reduction in its cost. Call on us.

✦ ✦ ✦

We make a complete line of nails in various sizes and types. Also the following kinds of wire:

BRIGHT BASIC
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ANNEALED
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TINNED
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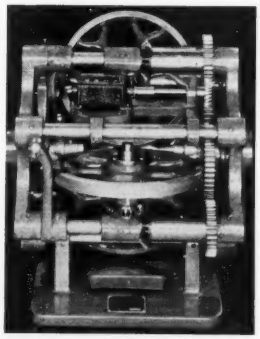
PATENT PENDING



IS the development of a new mechanical principle in wire measurement. It can be applied to all kinds of wire and cord—bar, insulated, armored, twisted pair, oval, angular and odd shaped without the necessity of adjustment, and with extreme practical accuracy.

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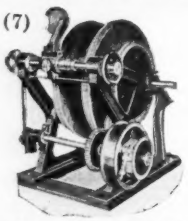

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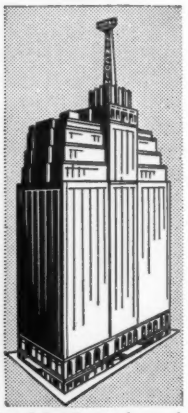

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consequently a universal cleaner would be a difficult thing to manufacture.

The temperature of all cleaners for this class of work are most successfully operated at as near the boiling point as possible.

2. If there are any soap or emulsified compounds formed with the material to be removed and the constituents of the cleaner, it is essential to have a hot water rinse after the cleaning operation. Cold water will congeal a film that will react with the acid of the pickle, and create an insoluble acid coating that will affect the character of any metallic coating subsequently applied.

3. Both sulphuric and muriatic acids are used to remove oxides caused by heat friction in the drawing operation or scale, but in our opinion they do not do a good job as they are now used. We found it necessary to develop a pickling method whereby all imbedded scale, residues left from ordinary pickling operations and all foreign matter is removed so that there will be no inclusions in the metal coating and also give a perfect bond between the metal coating and the base.

Steel wire pickled in any acid is not clean even if given a good rinsing. It is our experience that this is the main cause of imperfect coatings.

In answer to the question, advise that if the work is not thoroughly rinsed after pickling that the tinning baths will become contaminated and the tin coating will have inclusions that will materially effect any protection against corrosion. Of course, the regular acid flux should be used.

4. It is an unsettled question as to whether pure single metal or an alloy afford the best protection. Many alloys form electrical couples that accelerate corrosion in a damp atmosphere. While terne plate, a mixture of lead and tin, gives in some cases a better protection than lead alone, it is not as good as tin alone in other instances.

For refrigerator trays it will be found that tin alone will be the best. The Public Health authorities would have to decide if lead can be used on articles that may come in contact with food products.

5. There is no data available to answer this question. The salt spray test at its best can only indicate the weaker points of the metallic coating. The amount of tin used on a definite area will probably not be uniform, and unless the work is properly prepared, the heaviest coating may break down first due to the inclusions.

We have done considerable work on similar problems, and wish to thank you for the opportunity of expressing our opinions. The courtesy in referring your member's inquiry to us is appreciated and we will be pleased to assist further in any way you may request.

Answer No. 5

The Wire Association:

In answer to question No. 1, we manufacture our trays from Bright Basic Wire which has a practically clean surface. To clean these for the best result in tinning we immerse them in a hot solution of caustic soda.

2. After these trays are cleaned we wash them in cold running water before pickling.

3. These trays are then pickled in muriatic acid of 20 degrees strength. The length of time kept in muriatic acid is about 10-15 minutes. There may be a time that the wire is a little scaley and it may take 20-25 minutes, but the average pickling time is not over 10-15 minutes. After pickling in muriatic acid they are carried along, without cleaning, into our soldering fluid tank. They are taken from the tank as fast as we can draw them out of the tank to retin them.

In other words, the length of time they are in the soldering fluid is very short and is only to prepare the materials for tinning that we use the soldering fluid. We use the purest straight tin on all our kitchenware articles.

There is on the market a number of trays that are dipped in a solution which contains 60% ton and 40% lead. The temperature to get a good finish on articles of this kind would be approximately 700 degrees..

5. We cannot give you anything definite on the number of ounces of tin per square foot of surface to stand the salt spray solution.

It depends wholly on the article. We have never had any experience whatsoever on the salt spray solution on a tinned article. We never heard of it only on galvanizing.

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New Light on Wire Drawing

(*Continued from page 72*)

work has been done, would be the same for every material, but the results obtained leave no room for doubt on this point. There is, however, one aspect of this section of the work on which further research is required. When the tension necessary to produce the wire is plotted against the angle of the die, the curves obtained when they are drawn through the actual individual observations are not truly smooth but appear to suggest a periodic waviness. That this may be so is also strongly supported by other observations which have been obtained elsewhere. If this is confirmed it will lead to the very important practical conclusion that the die angle must be maintained very accurately at the ideal angle, a deviation in certain cases of as little as only ¼ deg. making a difference of the order of 10 per cent in the power consumed.

✦ ✦ ✦

Optimum Angle

ANOTHER and by no means self-evident result to which this work has led is that the opti-

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mum angle appears to be independent, at any rate within a fraction of a degree, of the amount of reduction effected at each pass. For reductions of area of 20 per cent and 35 per cent the minimum in the power-die-angle curve occurs in each case at about 5 deg. to 6 deg. For the heavier reductions, however, the results have led to another important conclusion. With severe passes the general shape of the curve is not essentially different from that with lighter ones, but the steepness of the initial portion of the curve for small values of the die angle is greatly accentuated, whilst the final part after the minimum has been passed shows but a very small increase in the power needed. It is evident that for such passes the use of dies with an agle smaller than that corresponding with the minimum in the curve may be exceedingly wasteful in power and that it is then safer to err on the side of slightly too steep an angle than too small a one.

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TO give some concrete idea of the order of the variations in the tension necessary, and hence of the power consumed at a given speed of drawing, the following figures may be quoted. They refer to a 70:30 brass wire, in the fully annealed condition, which was reduced in area 35 per cent in a single pass. The die used consisted of tungsten carbide, the diameter of the original wire being 0.072 in. For a die angle of 3 deg. the pull required was 124 lbs., when the angle was 5½ deg. this had fallen to 83 lbs., after which it rose as the die angle was further increased to 7 deg. to 90 lbs. The waste of power with the smallest angle will at once be appreciated.

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The continuation of this article will be published in the April issue.

WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames—16" Frames, 8" Frames —Take-Up Frames, Wire Pointers—Puller Tongs.
General Castings for Wire Mill use.
Circulars on Request.
E. J. Scudder Foundry & Machine Co.
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BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

ANNEALING FURNACES
See Furnaces—Various Headings

ANNEALING POTS AND BOXES
National Wrought Iron Annealing Box Co., Washington, Pa.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.

CHROME NICKEL—Construction
National Wrought Iron Annealing Box Co., Washington, Pa.

CLEANING & PICKLING EQUIPMENT
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COILERS—Sheet and Wire
H. J. Ruesch Machine Co., Newark, N. J.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Composition
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Vianney Wire Die Works, New York.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEER—Consulting Wire Mill
Jagielski, Otto, Yonkers, N. Y.
Lewis, Kenneth B., New York, N. Y.

EYELETS—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FURNACES—Annealing
Electric Furnace Co., Salem, O.

FURNACES—Automatic
Electric Furnace Co., Salem, O.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.

FURNACES—Electric
Electric Furnace Co., Salem, O.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.

FURNACES—Wire
Electric Furnace Co., Salem, O.

GALVANIZING KETTLES—
National Wrought Iron Annealing Box Co., Washington, Pa.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Wm. M. Parkin & Co., Pittsburgh, Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thompson-Judd Wire Mach'y Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

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Name .....

Address .....

Nature of Business .....

BUYERS' GUIDE, Continued

MACHINERY—Copper Wire Drawing and Rolling
Kratos-werke Aktiengesellschaft Gruna 1, SA. Germany
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Measuring Wire & Cable
Lyon Measuring Machine Division of Barbour Welt ng Co., Montello, Mass.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
H. L. Reusch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rubber Strip Covering
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila Pa.
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
F. B. Shuster Co., New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Kratos-werke Aktiengesellschaft Gruna 1, SA. Germany
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R B. Hayward Co., Chicago, Ill.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS—See Machinery—Rolling Mill

ROLLS—
Lewis F'dry & Machine Co., Pittsburgh, Pa.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

SPOOLS—Aluminum Alloy
Lestershire Spool Co., Johnson City, N. Y.

STEEL PLATE CONSTRUCTION—
National Wrought Iron Annealing Box Co., Washington, Pa.

STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel Plate
National Wrought Iron Annealing Box Co., Washington, Pa.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Enameled For Coils
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Steel—Also Coppered Steel—Also Glavanized Steel
Keystone Steel & Wire Co., Peoria, Ill.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

Electric Cable and Wire Rope Machinery :

STRANDERS	Planetary & Rigid Frame types (*horizontal and vertical.*) High-Speed Tubular and Built-up types.
BUNCHERS	High-speed types for spools up to 1500 lb. capacity.
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CLOSERS & CABLERS	For electric cable in Planetary and Angular types.
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TAPING HEADS	For applying steel tape in Eccentric and Concentric high-speed types.
JUTE & BURLAP	Applying Heads.
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WINDERS	For steel and copper, in single or multiple head units.
COILING MACHINES	Power or manual drive for package coiling—also for warehouse and shipping room use.
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ELECTRIC PATCH VULCANIZERS	
SATURATING, WAXING & GREASING TANKS	Gas fired and Electrical.
WIRE TINNING MACHINES	Gas fired and Electrical.
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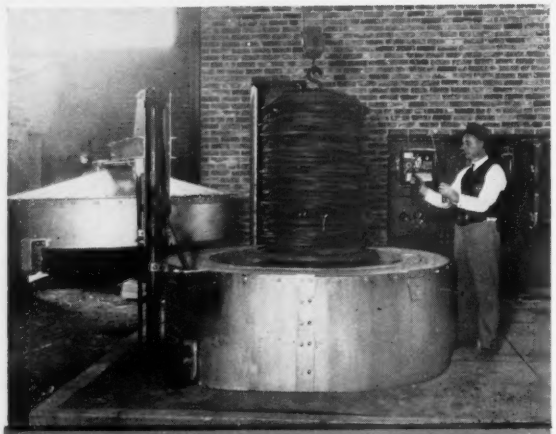
CUTTERS	For wire rope, cable and chain.
SPOOLS	Heavy-duty for Rope-Mills and Cable-plants.

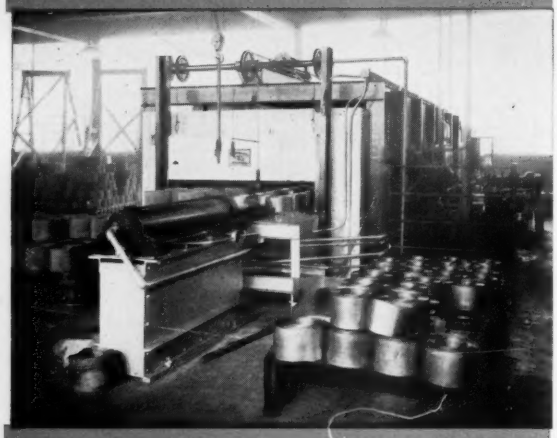
Send for descriptive catalogue.

ELECTRICAL WIRE AND CABLE—WIRE ROPE AND CORDAGE MACHINERY

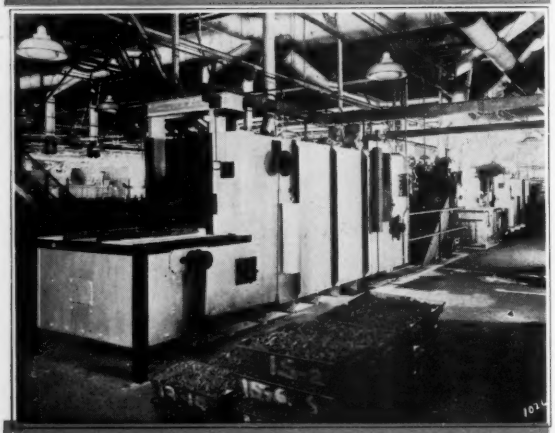
FURNACES
OIL + GAS + ELECTRIC



One of an installation of Circular Pit Type Electric Furnaces, used for annealing rod in coils in a prominent steel plant.



Return Recuperative Furnace annealing rolls and coils—the heat from finished product preheats ingoing material.



Heat treating miscellaneous springs, automatically, uniformly and economically. This unit consists of hardening furnace, quench, washing machine and draw furnace—arranged in line.

We build the furnace to fit your job

Regardless of the size, shape, or weight of your products,—the process, the accuracy of treatment or tonnage required, we can build a furnace to handle it uniformly, economically and to meet your production schedules.

Practically everything from small steel balls for bearings to pressure vessels weighing 350,000 lbs., and structural shapes up to 90 feet in length are being successfully handled in our furnaces.

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We have developed an inexpensive atmospheric medium and built controlled atmosphere continuous furnaces for bright and clean annealing . . . for preventing oxidation and decarburization in heat treating . . . for continuous copper brazing . . . and luminous flame furnaces for heating for rolling or forging with complete absence of scale.

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THE ELECTRIC FURNACE CO.
SALEM, OHIO.

Fuel Fired Furnaces

Electric Furnaces